

NAWS-CL TP 008

Coso Monitoring Program
October 1995 Through September 1996

by
S. D. Lager
B. R. Johnson
Public Works Department

JANUARY 1997

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**NAVAL AIR WEAPONS STATION
CHINA LAKE, CA 93555-6100**



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Naval Air Weapons Station

FOREWORD

This report presents the status of the Coso Monitoring Program conducted for the period October 1995 through September 1996 by the Naval Air Weapons Station (NAWS), China Lake, Calif. The investigation, funded under the NAWS Coso Geothermal Development Program, is being conducted to provide baseline information on hydrology and surface geothermal activity in the Coso Hot Springs area.

This report was reviewed for technical accuracy by Allan M. Katzenstein and Steven C. Bjornstad (NAWS 83G00D).

Approved by
W. OSTAG
Capt., U.S. Navy
Public Works Officer
15 January 1997

Under authority of
S. DOUGLASS
Capt., U.S. Navy
Commanding Officer

Released for publication by
J. DODD
Capt., U.S. Navy
Director, Shore Station Management

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13. ABSTRACT <i>(Maximum 200 words)</i> (U) The Coso Monitoring Program is a continuing effort in support of the Navy's geothermal resources within the Coso Known Geothermal Resource Area (Coso KGRA). A substantial body of reports has been established on this project (15 technical publications) and the project is essentially the same year to year, therefore much of the text of each report reiterates previously published information. This year's report concentrates on data presentation and interpretation; the reader is referred to the 1993/1994 summary report (NAWS-CL TP 006) for detailed descriptions of the overall project and the individual sites monitored.				
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INTRODUCTION

The Coso Monitoring Program was initiated in 1978 to gather baseline data on the surface and near-surface geothermal activity at Devils Kitchen and Coso Hot Springs located inside the boundaries of the Naval Air Weapons Station (NAWS), China Lake, Calif., the main thermal sites within the Coso Known Geothermal Resource Area (Coso KGRA). This report represents the nineteenth year of continuous data collection.

The format of the report for the current reporting period hasn't been changed from last year's report. A substantial body of reports has been established on this project (15 technical publications) and the project is essentially the same year to year, therefore much of the text of each report reiterates previously published information. This year's report concentrates on data presentation and interpretation and the reader is referred to the 1993/1994 summary report (Reference 1) for detailed descriptions of the overall project and the individual sites monitored.

Seasonal and diurnal variations of the thermal activity in these hot spring areas continue to be evident. Overall, the level of activity has been very stable during this reporting period.

Monitoring sites of the Coso Hot Springs area and type of data collected at each site are presented in Table 1. The location of each site is shown in Figure 1.

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TABLE 1. Monitoring Functions and Locations.

Monitored sites	Continuous steam flow	Wellhead pressure	Periodic water level	Periodic water temperature	Water level photography	Water chemistry	Ambient temperature	Barometric pressure	Relative humidity	Wind speed and direction
Schober's Resort (Wells 4A-2, 3)	X									
Well 4A-4				X ^a						
Well 4H-4	X				X ^b		X			
Well 4P-1					X ^b	X	X			
Well 4H-8 (Coso No. 1)			X ^c				X			
Devils Kitchen	X				X ^b					
Observation Well No. 1					X ^b					
Observation Well No. 2					X ^b	X	X			
South Pool								X	X	X
Weather Station										X

^aLess than weekly monitoring.

^bWeekly monitoring.

^cWeekly shut-in wellhead pressures.

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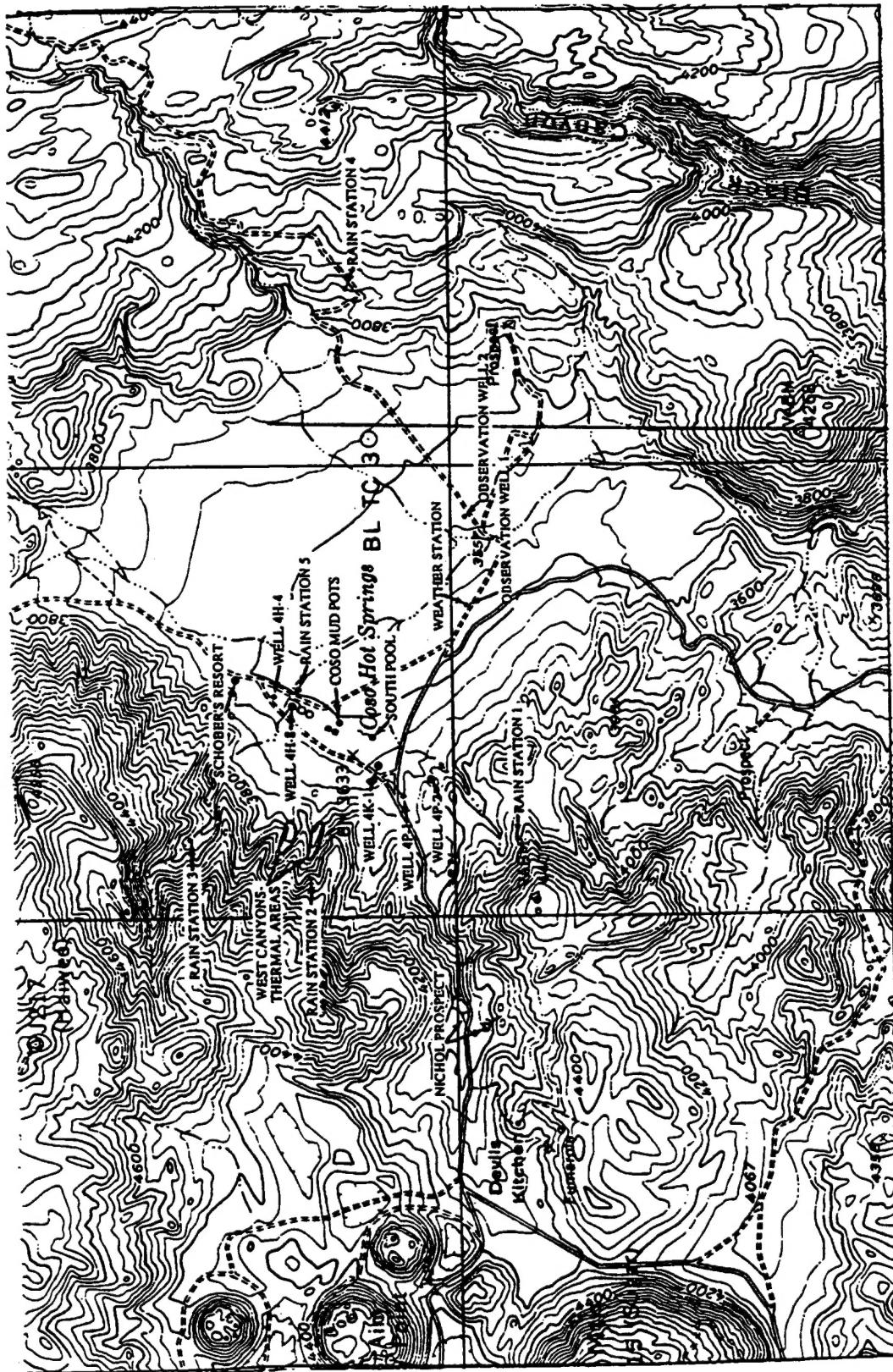


FIGURE 1. Coso Known Geothermal Resource Area Monitoring Sites.

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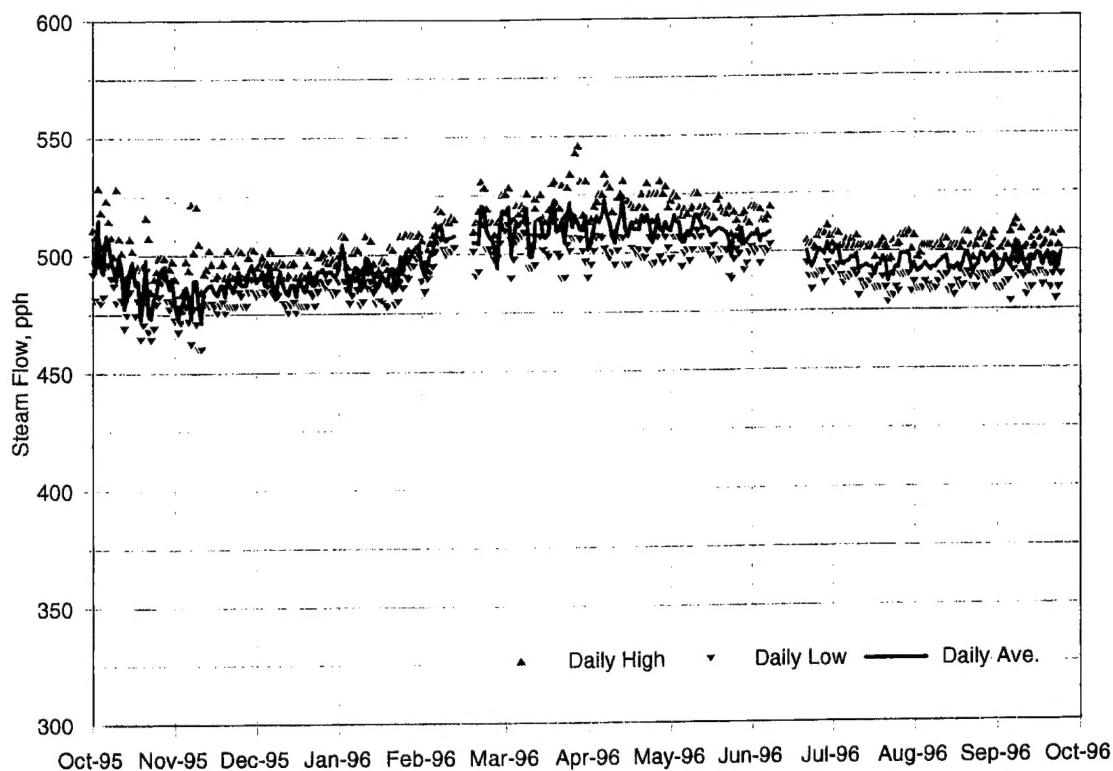


FIGURE 2. Devils Kitchen Steam Flow, October 1995 Through September 1996.

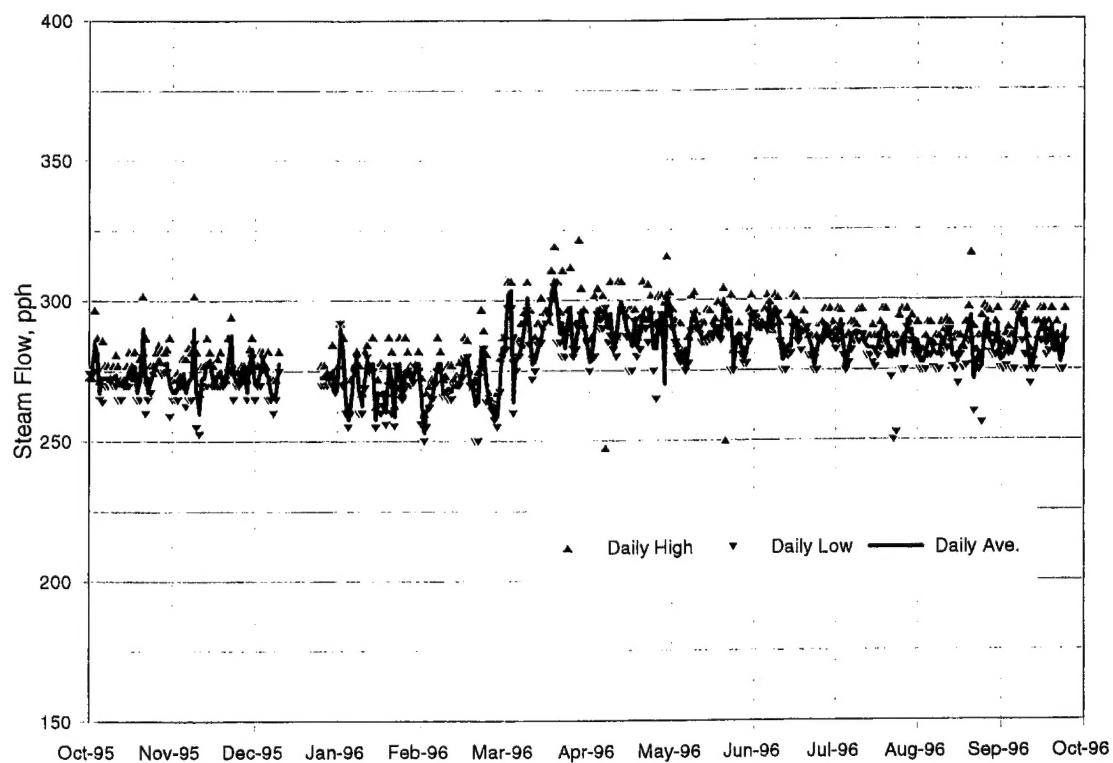


FIGURE 3. Well 4H-4 Steam Flow, October 1995 Through September 1996.

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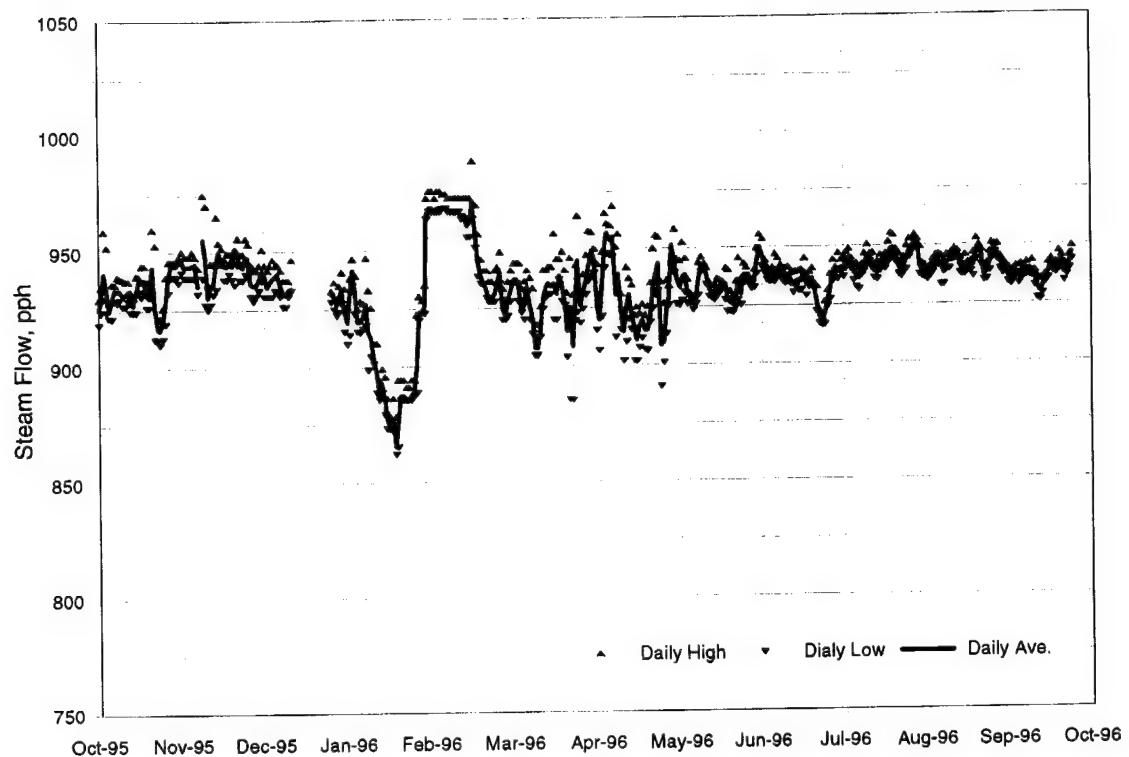


FIGURE 4. Wells 4A-2 and 4A-3 Steam Flow, October 1995 Through September 1996.

**COSO HOT SPRINGS MUDFIELD
PHOTOGRAPHIC RECORD**

A weekly photographic record was initiated in January 1978 to document the fluctuation in fluid levels in several of the more prominent mud pots in the Coso KGRA. Over the years the photo record has provided a clear picture of this hot springs thermal activity. It has demonstrated the sensitivity of the hot springs to both seasonal weather changes and individual weather events, such as summer thunderstorms. It has also chronicled the changes in thermal activity that occurred throughout the Coso Hot Springs area in the late 1980s. This weekly photo record was continued through this reporting period and is catalogued and stored at the Geothermal Program Office.

Selected photographs, Figures 5 through 13, show the typical level of thermal activity in the hot springs area throughout the past year.



FIGURE 5. Resort Mud Pot Area, August 1996.

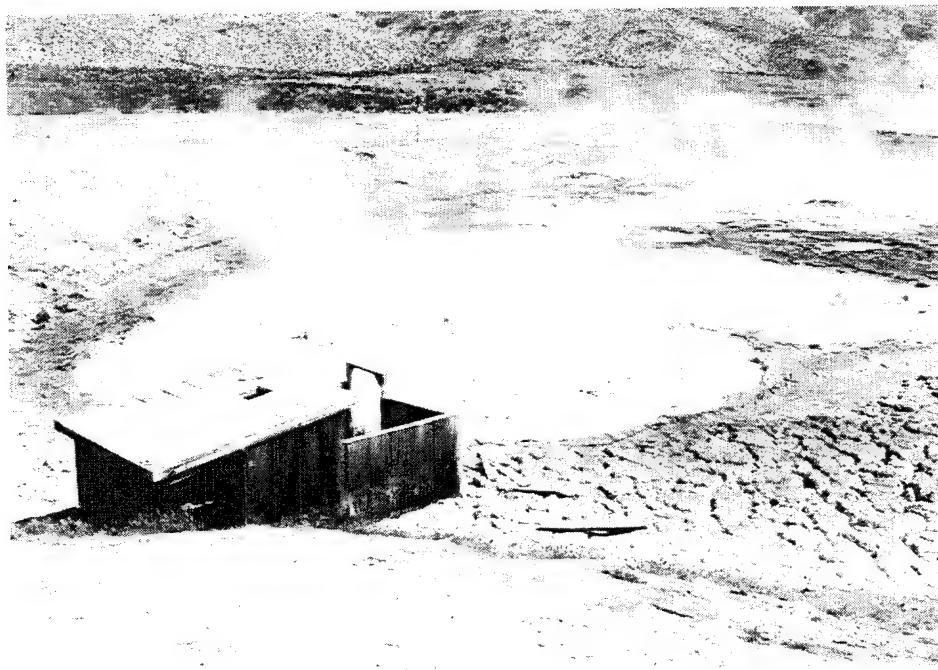


FIGURE 6. South Pool, High Water Level, May 1996.

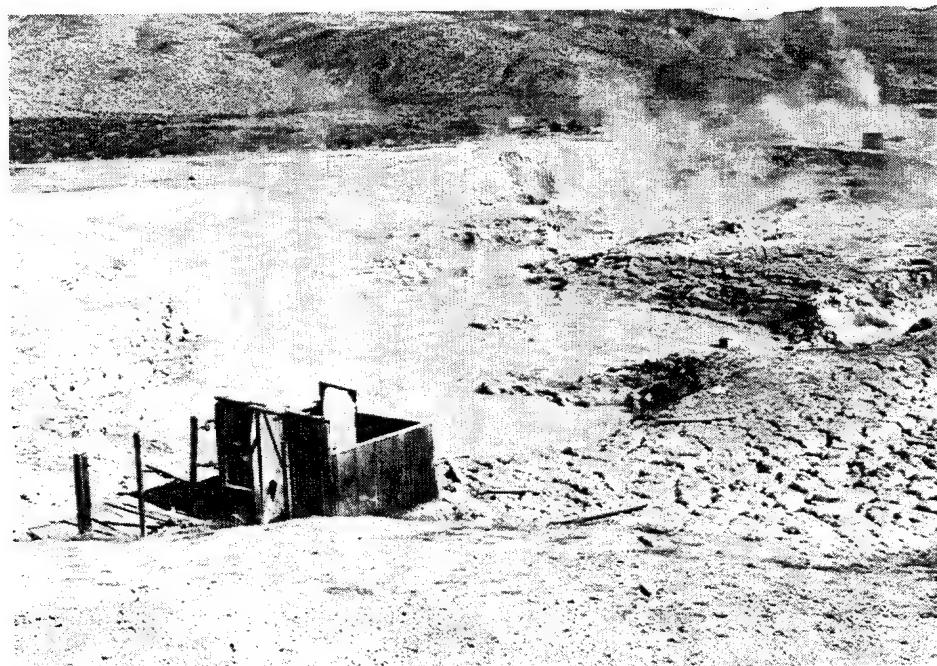


FIGURE 7. South Pool, Low Water Level, September 1996.

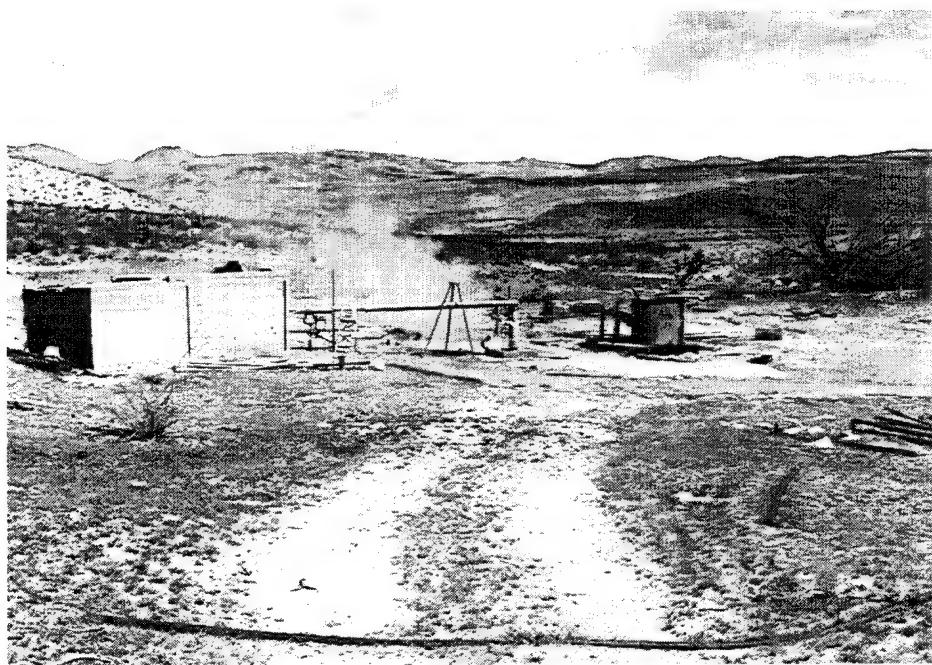


FIGURE 8. Schober's Resort Area, March 1996.



FIGURE 9. West Canyon, Looking West Up Canyon, March 1996.



FIGURE 10. Northern West Canyon Land Slump, March 1996.

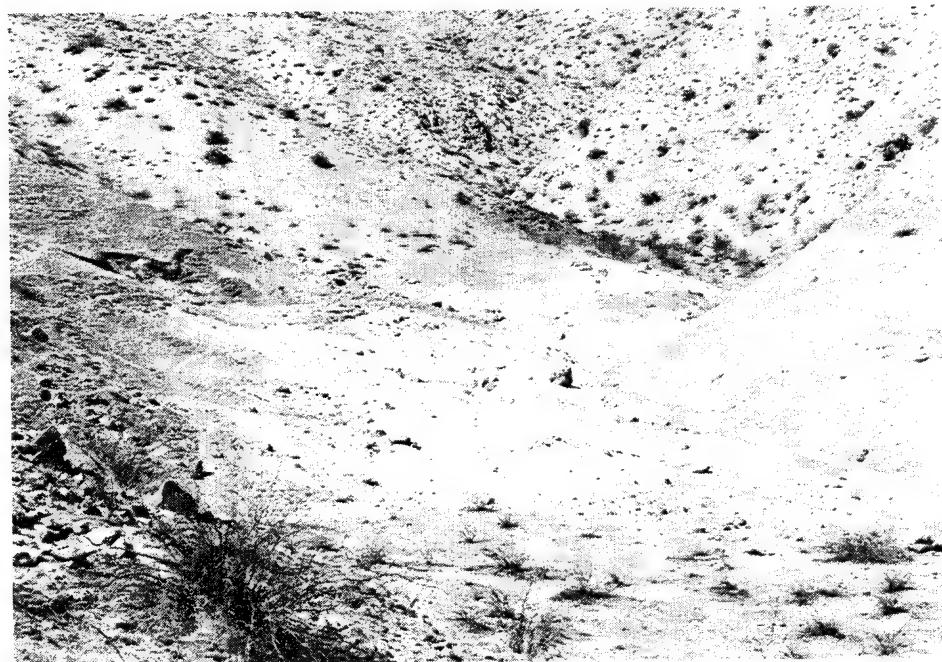


FIGURE 11. Northern West Canyon Land Slump, October 1996.



FIGURE 12. Nichol Prospect Warm Pool, March 1996.

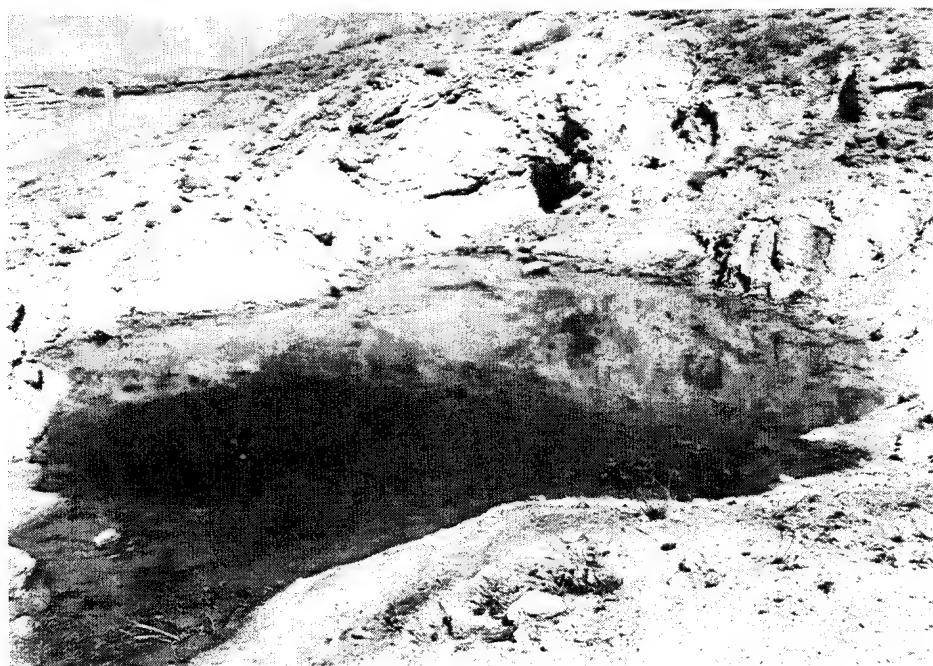


FIGURE 13. Nichol Prospect Warm Pool, August 1996.

WATER LEVEL MONITORING

OBSERVATION WELLS

Groundwater levels are monitored in four wells. Weekly measurements are taken at wells 4P-1, OB-1 and OB-2, while the water level of another well, Coso No. 1 (4H-8), is determined indirectly from temperature logs and weekly wellhead pressure readings. These level data are listed in Table 2. Figure 14 shows a summary graph of Coso observation well water levels from 1980 to the present. Depth to water data have been translated to true elevation.

The fluid level elevation in well 4P-1 continues to gradually rise, from 3590.5 feet above sea level (ASL) at the beginning of the monitoring program in 1978 to 3613.3 feet ASL at the end of September 1996. Well 4P-1 is a hot, steam condensate well and is located on the upthrown side of the Coso Hot Springs fault, about 150 feet from the fault line, toward the south end of the hot springs area. It is completed in alluvial fill material. As discussed in Reference 2, this well appears to tap a small perched aquifer that is not directly connected to the regional aquifer.

Observations wells OB-1 and OB-2 are water wells located in the Upper Coso Basin, about three-quarters of a mile east of the fault line. Both of these wells are completed in sedimentary, valley fill material. The water level elevation in OB-1 continues the decline described in previous reports, dropping from about 3432 feet ASL in 1988 to about 3386.8 feet ASL by September 1996. The water level in OB-2, however, rose about 10 feet during 1989 and 1990. This level appears to have stabilized at about 3365 feet ASL.

Coso No. 1 is located toward the north end of the Coso Hot Springs fault and is completed in bedrock. The fluid level in Coso No. 1 declined slightly from 3473 to about 3465 feet ASL between 1978 and October 1987. At that lowered fluid level, the well began to boil. The fluid level dropped rapidly to about 3410 feet ASL by September 1988, and the wellbore became plugged with salt and scale. Coso No. 1 was rehabilitated in 1993 and shut-in to reduce boiling and scaling. The current fluid level (determined from the temperature gradient log) is at about 3300 feet ASL.

Shut-in wellhead pressures for Coso No. 1 are recorded weekly from both the 4-inch wellbore and the 7-inch intermediate casing around the wellbore. The wellbore is completed to 370 feet in bedrock, while the intermediate casing is set to 194 feet at the alluvium/bedrock interface. Table 3 is a listing of the current year's recorded pressures. Figure 15 is a summary graph of these pressures from November 1993 to the present.

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TABLE 2. Observation Well Water Level Data.

Date	Water level elevations, ft, AMSL			
	Ground level at well location, ft, AMSL		Ground level, ft, AMSL	
	4P-1	OB-1	OB-2	
	3662.0	3570.0	3560.0	3615.0
Water level measurements			Water level ^a	
	4P-1	OB-1	OB-2	Coso 1
10 Oct 95	3612.1	3387.9	3366.6	
17 Oct 95	3612.1	3386.8	3366.6	
24 Oct 95	3612.1	3386.8	3365.5	
31 Oct 95	3612.1	3386.8	3365.5	
7 Nov 95	3610.9	3386.8	3365.5	
14 Nov 95	3610.9	3386.8	3365.5	
24 Nov 95	3610.9	3386.8	3365.5	
28 Nov 95	3612.1	3386.8	3364.3	
5 Dec 95	3612.1	3386.8	3365.5	
12 Dec 95	3612.1	3386.8	3365.5	
3 Jan 96	3612.1	3386.8	3365.5	
9 Jan 96	3612.1	3385.6	3365.5	
16 Jan 96	3612.1	3385.6	3365.5	
24 Jan 96	3612.1	3386.8	3365.5	
31 Jan 96	3612.1	3386.8	3365.3	
7 Feb 96	3612.1	3386.8	3365.5	
14 Feb 96	3612.1	3386.8	3365.5	
21 Feb 96	3612.1	3386.8	3364.3	
28 Feb 96	3612.1	3386.8	3365.5	
6 Mar 96	3612.1	3386.8	3365.5	
13 Mar 96	3612.1	3386.8	3365.5	
20 Mar 96	3612.1	3386.8	3365.5	
27 Mar 96	3613.3	3386.8	3365.5	
3 Apr 96	3613.3	3386.8	3365.5	
10 Apr 96	3613.3	3386.8	3365.5	
18 Apr 96	3612.1	3386.8	3365.5	
25 Apr 96	3612.1	3386.8	3365.5	
2 May 96	3612.1	3386.8	3365.5	
9 May 96	3613.3	3386.8	3365.5	
15 May 96	3612.1	3386.8	3365.5	
23 May 96	3612.1	3386.8	3364.3	
29 May 96	3612.1	3386.8	3365.5	
5 Jun 96	3612.1	3386.8	3365.5	
12 Jun 96	3612.1	3386.8	3364.3	
20 Jun 96	3612.1	3386.8	3365.5	
26 Jun 96	3612.1	3386.8	3365.5	
3 Jul 96	3612.1	3386.8	3365.5	
10 Jul 96	3612.1	3385.6	3365.5	
17 Jul 96	3610.9	3385.6	3365.5	
24 Jul 96	3610.9	3385.6	3365.5	
1 Aug 96	3610.9	3385.6	3365.5	
7 Aug 96	3613.3	3385.6	3365.5	
14 Aug 96	3613.3	3386.6	3365.5	
21 Aug 96	3613.3	3386.8	3365.5	
28 Aug 96	3613.3	3386.8	3365.5	
4 Sep 96	3613.3	3386.8	3365.5	
11 Sep 96	3613.3	3386.8	3365.5	
18 Sep 96	3613.3	3386.8	3365.5	
26 Sep 96	3613.3	3386.8	3365.5	

^a Coso 1 water level is determined indirectly from temperature logs and weekly wellhead pressure readings.

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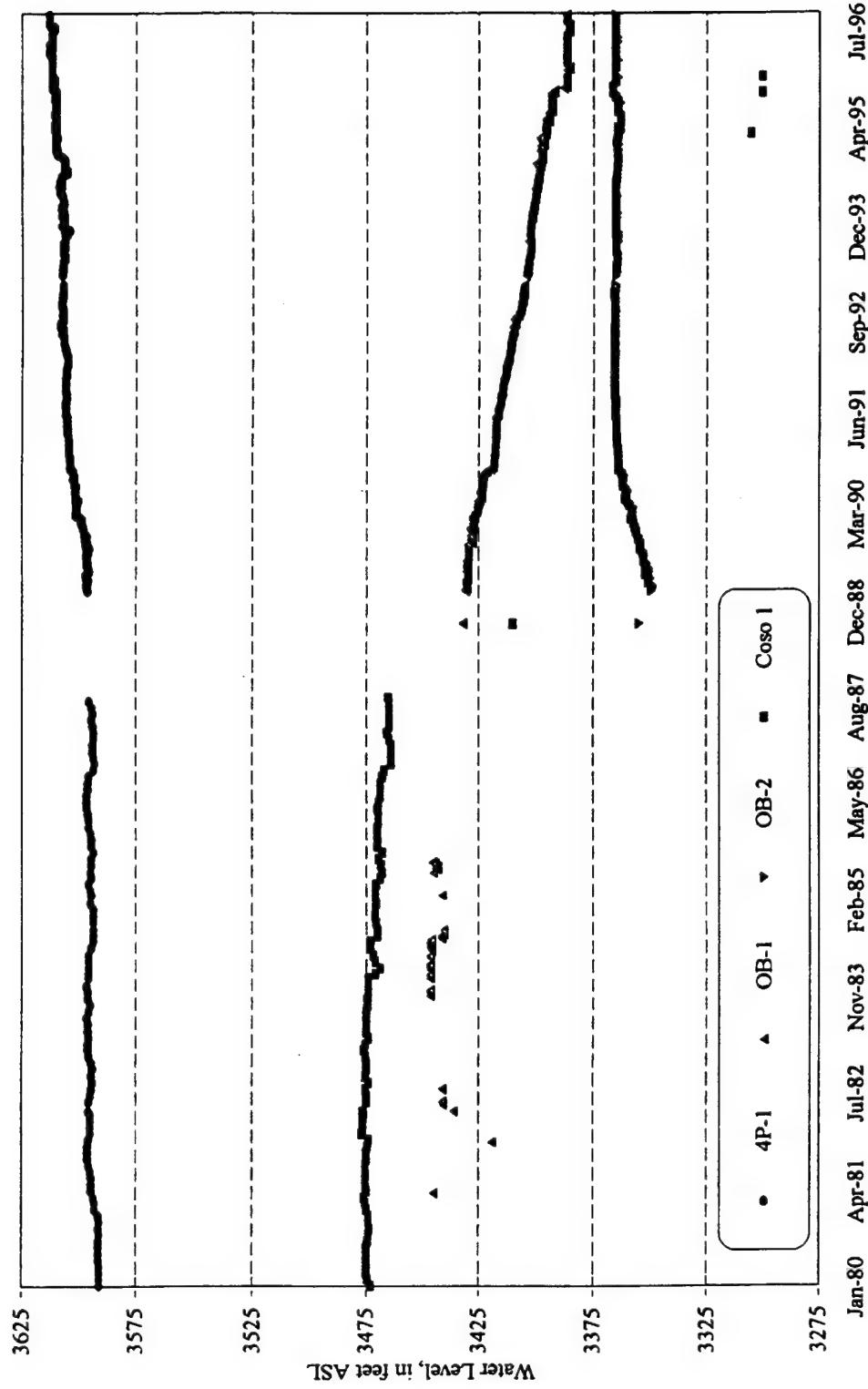


FIGURE 14. Water Levels in Coso Observation Wells, January 1980 Through September 1996.

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TABLE 3. Shut-in Wellhead Pressure, Coso No. 1.

Date	7-inch casing, psig	4-inch casing, psig
10 Oct 95	21.5	20.0
17 Oct 95	22.0	20.0
24 Oct 95	22.0	20.0
31 Oct 95	22.0	20.0
7 Nov 95	22.0	20.0
14 Nov 95	22.0	20.0
24 Nov 95	22.0	20.0
28 Nov 95	22.0	20.0
5 Dec 95	22.0	20.0
12 Dec 95	24.0	20.0
3 Jan 96	24.0	20.0
9 Jan 96	24.0	20.0
16 Jan 96	24.0	20.0
24 Jan 96	24.0	20.0
31 Jan 96	24.5	20.0
7 Feb 96	24.5	20.0
14 Feb 96	24.5	20.0
21 Feb 96	24.5	20.0
28 Feb 96	24.0	19.6
6 Mar 96	24.0	20.0
13 Mar 96	24.5	20.0
20 Mar 96	24.5	20.0
27 Mar 96	24.5	20.5
3 Apr 96	24.5	20.5
10 Apr 96	24.5	20.5
18 Apr 96	24.5	20.5
25 Apr 96	24.5	20.5
2 May 96	25.0	20.0
9 May 96	24.5	20.5
15 May 96	24.5	20.5
23 May 96	24.5	20.0
29 May 96	24.5	20.5
5 Jun 96	24.5	20.5
12 Jun 96	25.0	20.0
20 Jun 96	24.5	20.5
26 Jun 96	24.5	20.5
3 Jul 96	24.5	20.5
10 Jul 96	24.5	20.5
17 Jul 96	24.5	20.5
24 Jul 96	24.5	20.5
1 Aug 96	24.5	20.5
7 Aug 96	24.5	20.5
14 Aug 96	24.5	20.5
21 Aug 96	24.5	20.5
28 Aug 96	25.0	20.5
4 Sep 96	24.5	20.5
11 Sep 96	24.5	20.5
18 Sep 96	24.5	20.0
26 Sep 96	24.5	20.5

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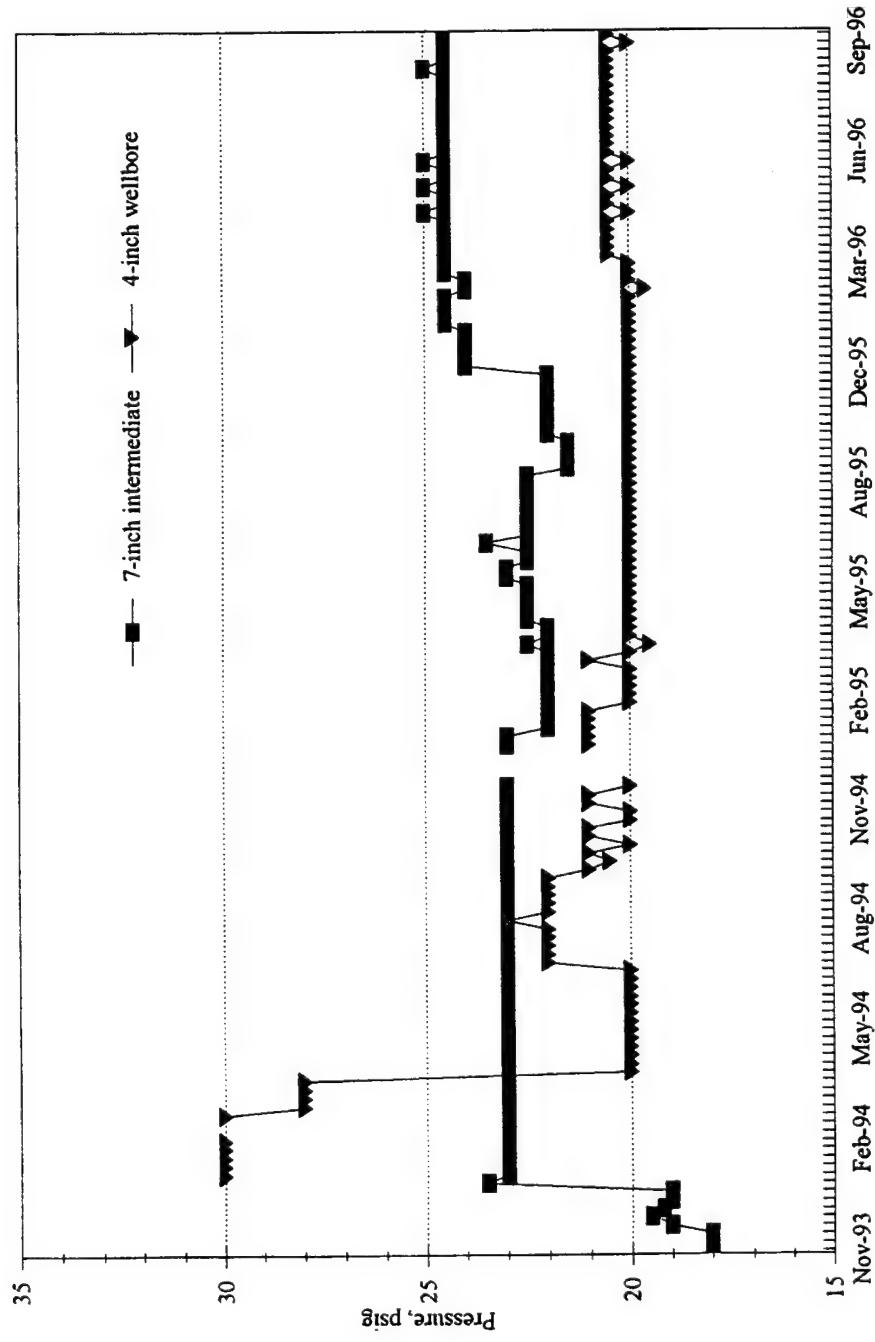


FIGURE 15. Shut-in Wellhead Pressure, Coso No. 1, November 1993 Through September 1996.

SOUTH POOL

The South Pool water level has continued the pattern of seasonal fluctuations throughout this reporting period, ranging from a low of 3612.2 feet in October 1995 to a high of 3620.4 feet in March of 1996 (Table 4). The pool's temperature is periodically measured, as conditions permit. Water temperatures for this period continued to average above 200 degrees Fahrenheit. The temperature and water elevations of the pool for January 1988 through September 1996, the period of increased activity, are shown graphically in Figure 16, while the pool elevation recorded for the entire monitoring program period is shown in Figure 17.

TABLE 4. South Pool Elevation and Temperature Changes.

Date	Elevation, ft	Temperature, °F	Date	Elevation, ft	Temperature, °F
10 Oct 95	3616.4	200	18 Apr 96	3620.0	211
17 Oct 95	3616.3	198	25 Apr 96	3620.1	209
24 Oct 95	3616.2	199	2 May 96	3620.4	208
31 Oct 95	3616.5	187	9 May 96	3619.6	208
7 Nov 95	3616.9	190	15 May 96	3619.5	207
14 Nov 95	3616.9	190	23 May 96	3619.0	206
21 Nov 95	3617.2	189	29 May 96	3619.4	205
28 Nov 95	3617.2	182	5 Jun 96	3619.1	204
5 Dec 95	2617.2	183	12 Jun 96	3619.4	204
12 Dec 95	3617.2	182	20 Jun 96	3618.5	210
3 Jan 96	3618.1	190	26 Jun 96	3618.3	no data
9 Jan 96	3618.4	no data	3 Jul 96	3618.1	204
16 Jan 96	3618.6	195	10 Jul 96	3617.9	205
24 Jan 96	3618.8	212	17 Jul 96	3617.6	207
31 Jan 96	3619.0	no data	24 Jul 96	3617.3	206
7 Feb 96	3619.0	205	1 Aug 96	3617.0	203
14 Feb 96	3619.1	202	7 Aug 96	3617.1	201
21 Feb 96	3619.3	205	14 Aug 96	3616.7	203
28 Feb 96	3619.7	205	21 Aug 96	3616.6	201
6 Mar 96	3619.7	206	28 Aug 96	3616.4	207
13 Mar 96	3619.4	204	4 Sep 96	3616.2	no data
20 Mar 96	3620.0	205	11 Sep 96	3616.3	211
27 Mar 96	3620.4	207	18 Sep 96	3616.3	211
3 Apr 96	3620.0	210	26 Sep 96	3616.3	211
10 Apr 96	3619.6	209			

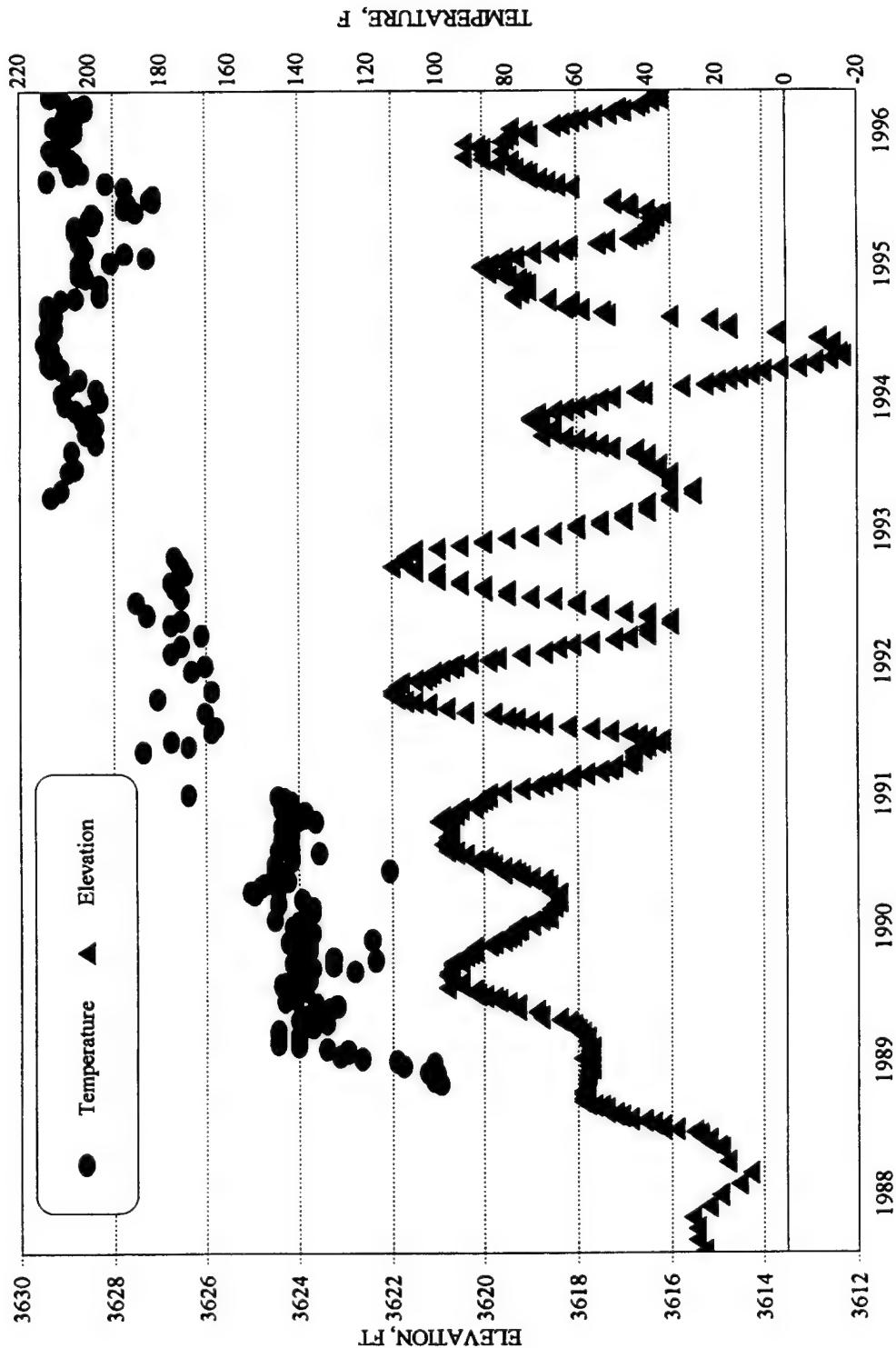


FIGURE 16. South Pool Elevation and Temperature, January 1988 Through September 1996.

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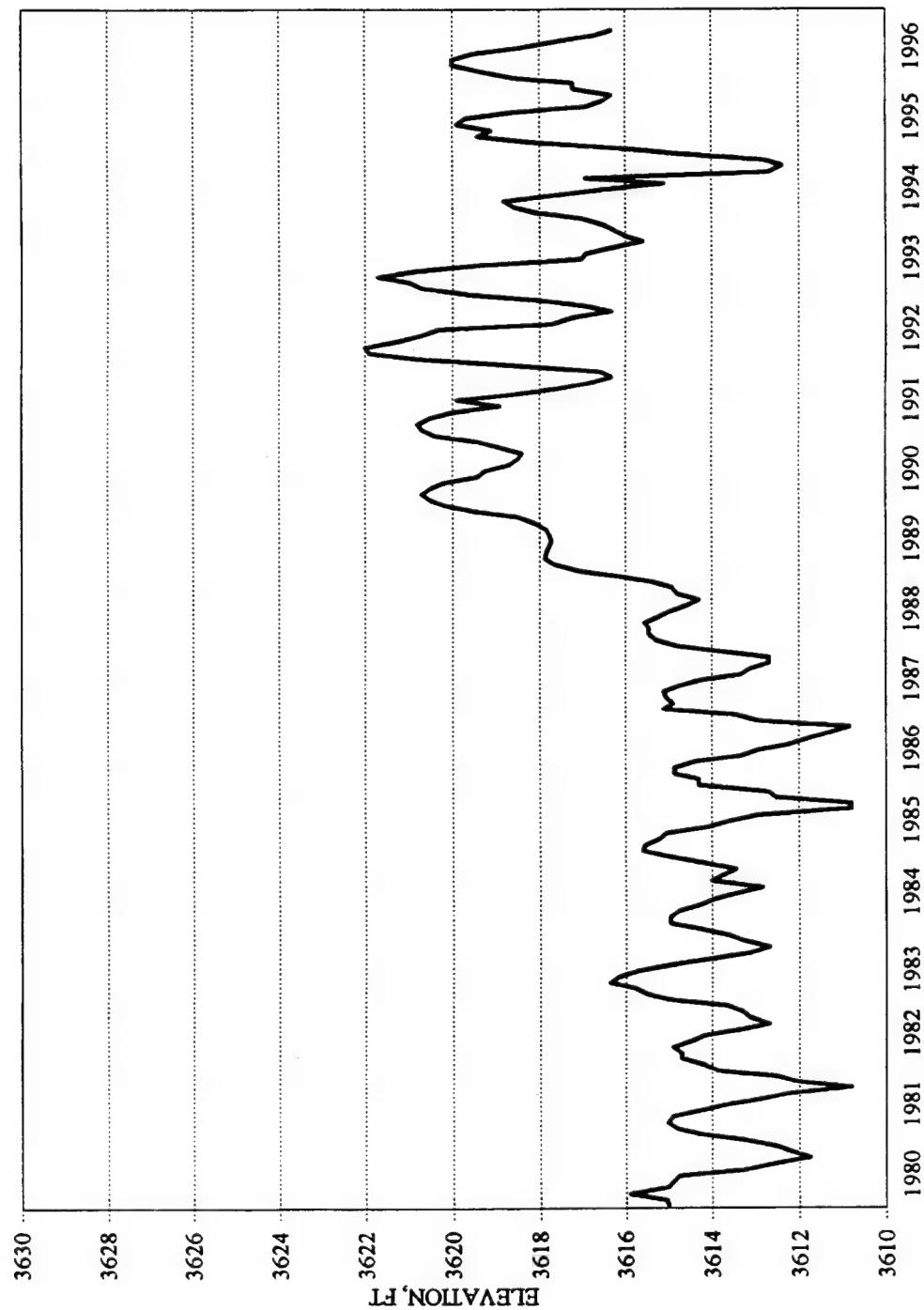


FIGURE 17. South Pool Elevations, January 1980 Through September 1996.

RAINFALL AT COSO RESORT AREA AND ROSE VALLEY

Rainfall in the Coso Hot Springs basin is monitored at five rain station sites, as mapped in Figure 1. Instrumentation at each site consists of a battery-operated long-term strip recorder that is triggered by a tipping bucket. The Rose Valley data are collected at the Los Angeles Department of Water and Power Haiwee Reservoir Plant. This year there were no interruptions in rainfall data collection.

Data from the Coso rain stations and the Rose Valley data from the Haiwee power plant are presented in Table 5 and Figure 18. Comparative rainfall data for the Indian Wells Valley (IWV), Rose Valley, and Coso Basin for the period 1967 through 1995 are shown in Table 6 and Figure 19. IWV data were gathered at Armitage Field, Naval Air Warfare Center Weapons Division (NAWCWPNS), and provided by a NAWCWPNS meteorologist.

TABLE 5. Rainfall Recorded at the Coso Rain Stations and Rose Valley.

Date	Coso Hot Springs area					Rose Valley	
	Tipping bucket stations (rainfall, in.)					Date	Rainfall, in.
	1	2	3	4	5		
03 Oct 95							
26 Nov 95	0.01	0.02				12 Dec 95	0.05
12 Dec 95	0.07					13 Dec 95	0.40
17 Dec 95			0.01			14 Dec 95	0.08
18 Dec 95			0.09			23 Dec 95	0.34
23 Dec 95	0.03						
24 Dec 95	0.10						
30 Dec 95			0.15				
31 Dec 96			0.03				
21 Jan 96			0.04			19 Jan 96	0.82
16 Jan 96	0.01					25 Jan 96	0.03
30 Jan 96		0.02				28 Jan 96	0.12
31 Jan 96		0.18	0.38				
01 Feb 96			0.04		0.02	31 Jan 96	0.01
17 Feb 96				0.01		01 Feb 96	0.20
19 Feb 96	0.02	0.03	0.01			02 Feb 96	0.01
20 Feb 96	0.04	0.14	0.20			20 Feb 96	0.48
23 Feb 96					0.02	21 Feb 96	0.20
26 Feb 96	0.05						
28 Feb 96		0.04	0.02				
01 Mar 96	0.01				0.03		
02 Mar 96							
07 Mar 96				0.08		05 Mar 96	0.06

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TABLE 5. (Contd.)

Coso Hot Springs area						Rose Valley	
Date	Tipping bucket stations (rainfall, in.)					Date	Rainfall, in.
	1	2	3	4	5		
09 Mar 96	0.06						
10 Mar 96	0.07						
12 Mar 96		0.08	0.04				
13 Mar 96		0.11	0.21	0.07		13 Mar 96	0.06
17 Mar 96					0.02	14 Mar 96	0.13
18 Mar 96					0.09	15 Mar 96	0.05
19 Mar 96	0.04						
29 Mar 96	0.06			0.02			
02 Apr 96					0.04		
07 Apr 96						01 Apr 96	0.01
14 Apr 96	0.02			0.01		17 Apr 96	0.02
17 Apr 96					0.02	18 Apr 96	0.11
21 Apr 96						25 May 96	0.12
25 May 96			0.06			26 May 96	0.13
29 May 96					0.01	27 Jun 96	0.01
26 Jun 96	0.02	0.03			0.03	13 Jul 96	0.26
12 Jul 96		0.03				28 Jul 96	0.10
30 Jul 96					0.01		
14 Aug 96	0.01				0.01		
14 Sep 96	0.01						
19 Sep 96	0.01		1.31				
TOTAL	0.64	0.68	1.13	0.16	0.30	TOTAL	3.8

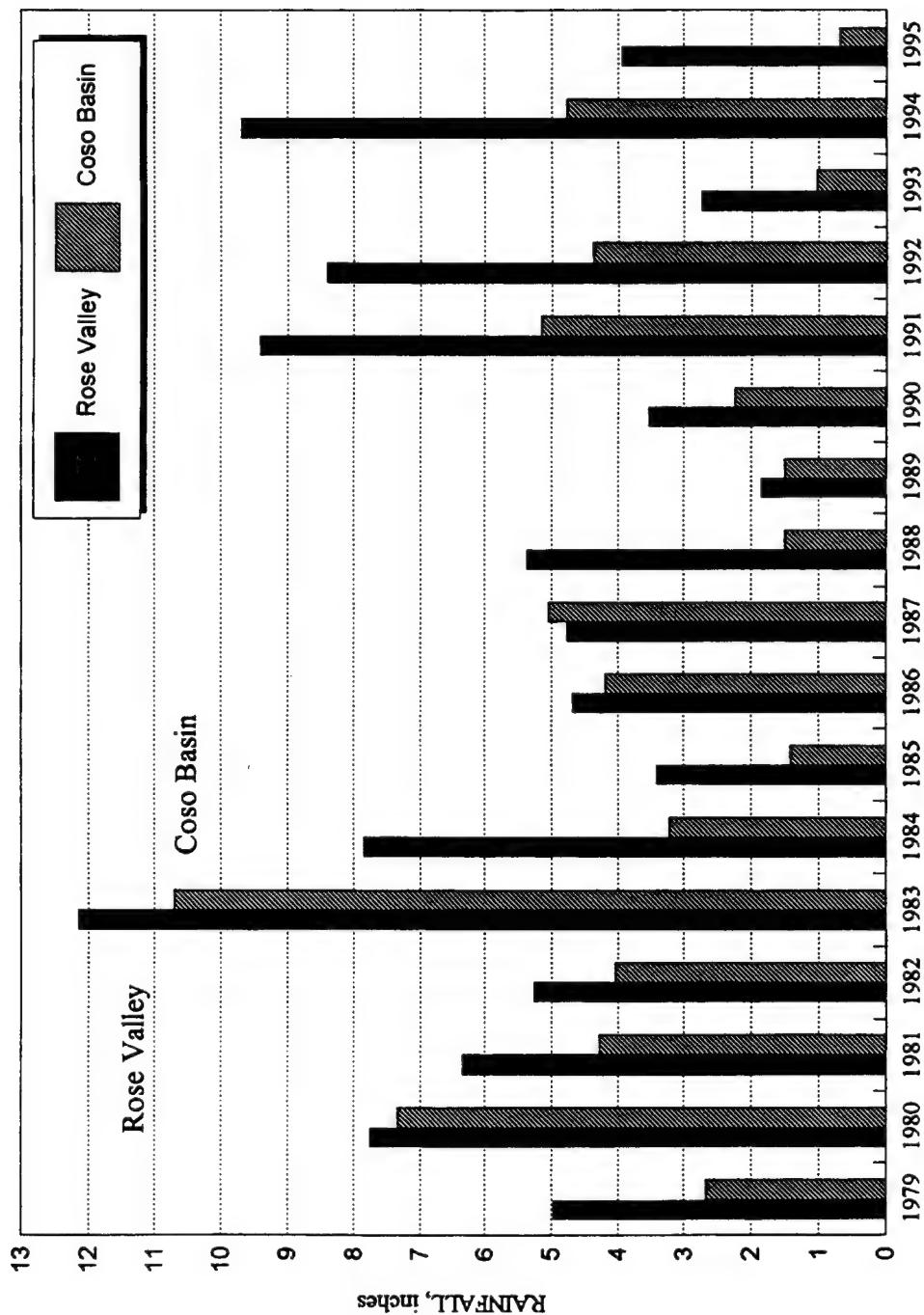


FIGURE 18. Comparison of Total Rainfall at Coso Basin and Rose Valley, 1979 Through 1995.

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TABLE 6. IWV, Rose Valley, and Coso Basin Rainfall.

Year	IWV	Rose Valley	Coso Basin
1967	4.28	4.32	
1968	3.16	3.26	
1969	5.55	8.80	
1970	3.74	6.45	
1971	1.47	2.87	
1972	1.24	1.90	
1973	2.58	4.56	
1974	7.46	9.19	
1975	1.64	2.79	
1976	3.74	8.50	
1977	4.67	8.34	
1978	10.68	12.61	
1979	5.56	4.97	2.67
1980	6.31	7.75	7.34
1981	4.49	6.34	4.28
1982	4.73	5.26	4.05
1983	10.56	12.14	10.70
1984	5.95	7.84	3.23
1985	1.29	3.42	1.42
1986	3.68	4.68	4.19
1987	4.43	4.77	5.04
1988	3.76	5.36	1.51
1989	0.94	1.85	1.51
1990	1.78	3.53	2.24
1991	7.83	9.41	5.15
1992	8.10	8.40	4.38
1993	0.94	2.83	1.04
1994	6.76	9.69	4.78
1995	7.88	3.80	0.69

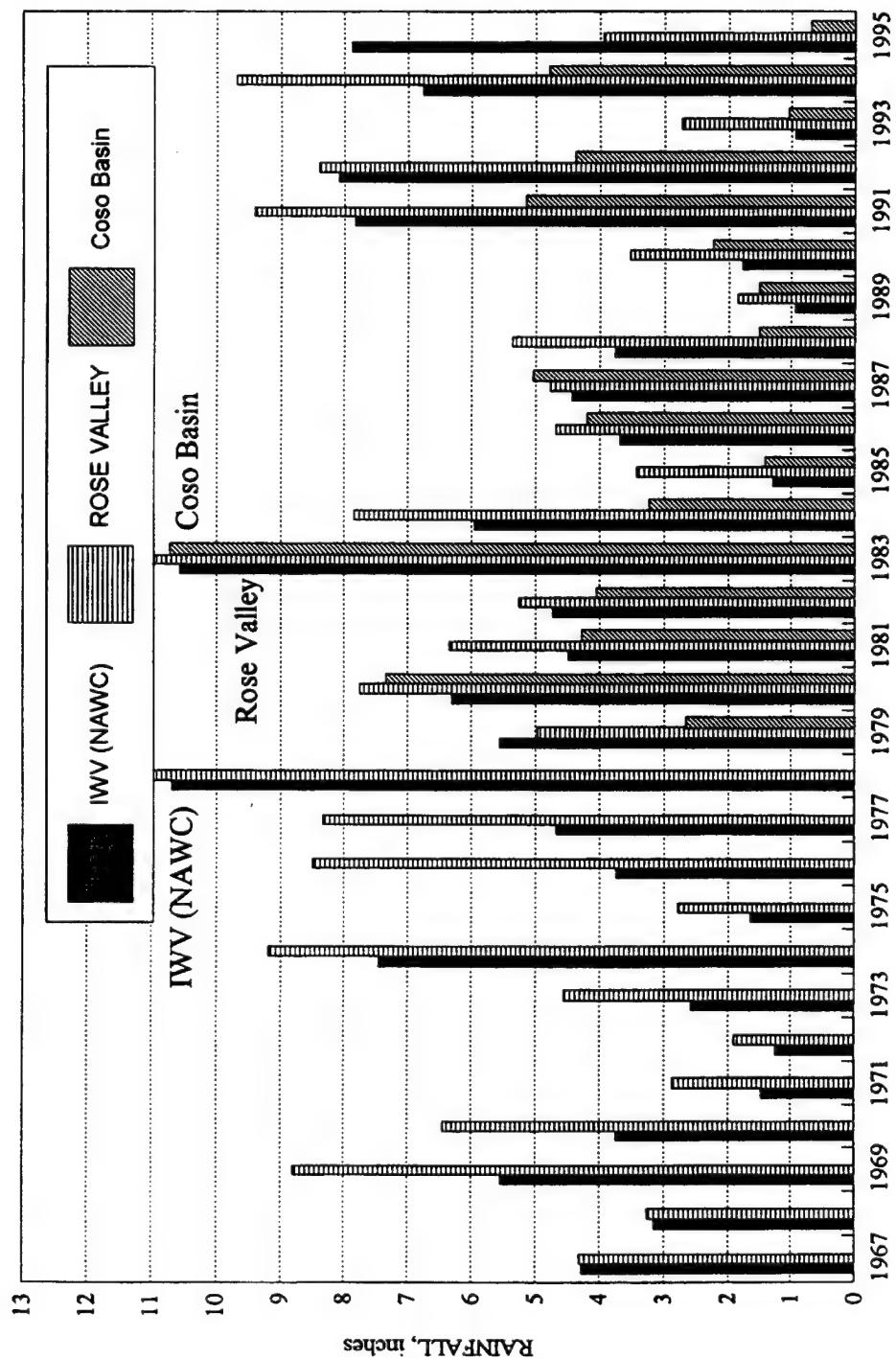


FIGURE 19. Comparison of Total Rainfall at IWV, Rose Valley, and Coso Basin Sites, 1967 Through 1995.

**COSO HOT SPRINGS MINI-WEATHER
RECORDING STATION**

Barometric pressure, ambient temperature, relative humidity, and wind speed and wind direction are recorded at Weather Station One, located adjacent to observation well OB-1. In March 1996 this station was integrated into the base-wide weather monitoring network. During this transition the data from January 1996 through March 1996 were lost. This site is now maintained by NAWCWPNS Geophysics Operation personnel.

Barometric pressure, ambient temperature, and relative humidity were collected hourly at Weather Station One from 19 January 1994 through 30 September 1996; these data have been consolidated into a graph (Figure 20). Actual hourly data are expansive and will not be published. It is available from the Geothermal Program Office upon request.

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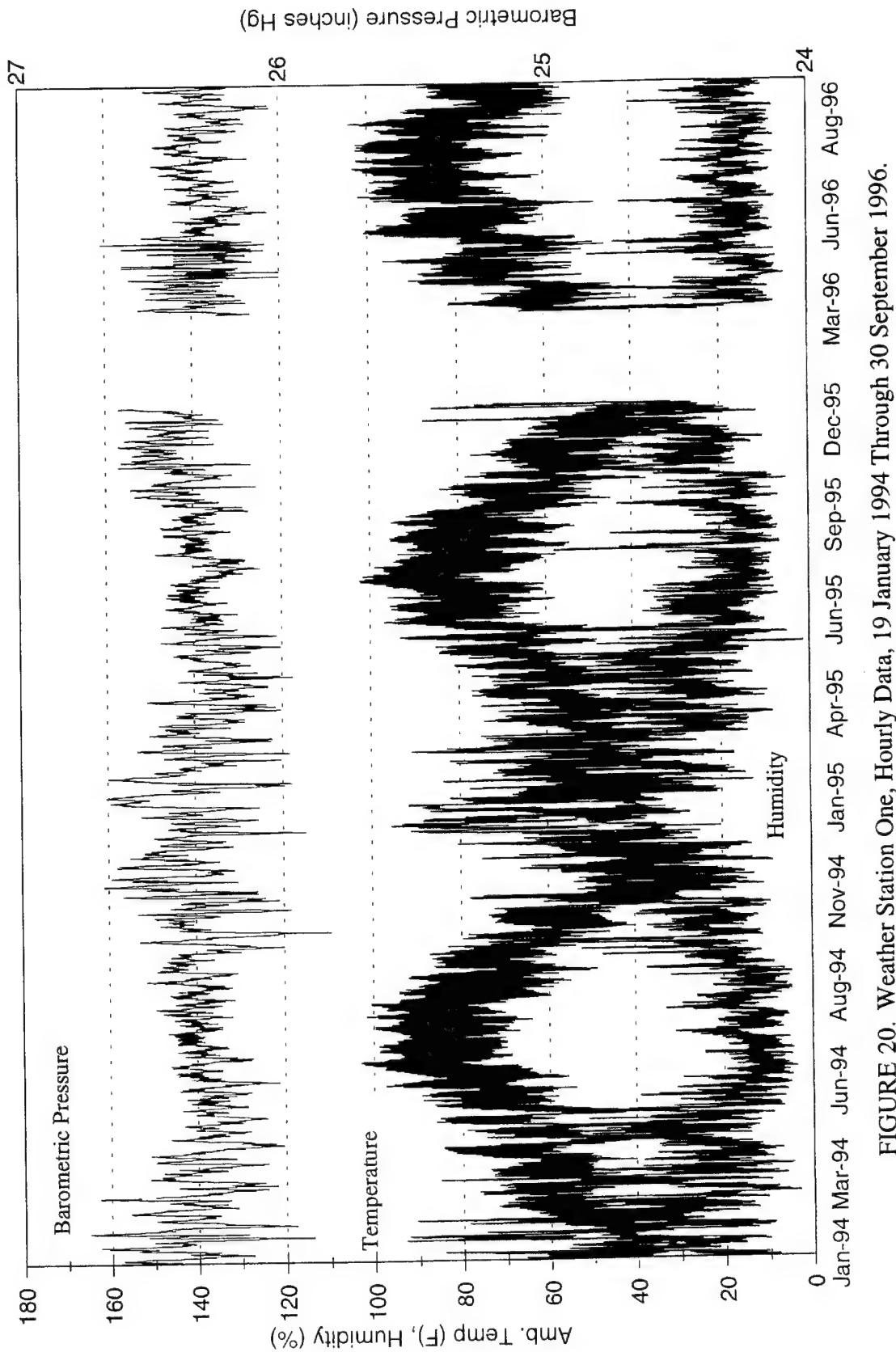


FIGURE 20. Weather Station One, Hourly Data, 19 January 1994 Through 30 September 1996.

WATER ANALYSIS OF COSO HOT SPRINGS AREA

Water samples were collected from several sites in the Coso Hot Springs area. These samples were analyzed for a suite of geothermal constituents by NAWCWPNS' Environmental Analysis Facility. The results are provided in Table 7. Wells 4K-1, Coso No. 1 (4H-4), 4P-1, and 4K-1, as well as sites at Devils Kitchen, South Pool, West Canyon, Nichol Pool, Nichol Prospect and the West Canyon were analyzed.

TABLE 7. Chemical Analysis of Coso Area Surface and Near-Surface Thermal Waters.

Constituents	Units	4A-1 2/28/96	4K-1 2/28/96	4P-1 2/28/96	Coso Well No. 1 2/28/96	Devils Kitchen 2/28/96	Nichol Pool 2/28/96	South Pool 2/28/96	West Canyon 2/28/96
Aluminum	mg/L	a	0.06	0.07	0.31	15.2	2.54	61.4	0.22
Antimony	mg/L	a	a	a	8.80	a	a	a	a
Arsenic	mg/L	a	a	0.07	4.47	0.16	0.76	0.44	a
Barium	mg/L	0.09	a	0.11	0.09	a	0.09	a	0.06
Bicarbonate	mg/L	84.30	41.50	86.90	223	a	a	a	1.32
Boron	mg/L	0.05	0.205	0.09	1.35	3.35	49.3	9.12	0.11
Bromide	mg/L	a	0.160	0.191	3.56	a	3.42	a	a
Calcium	mg/L	27.00	3.21	92.00	3.10	55.3	48.9	148	78.5
Carbonate	mg/L	0.269	0.854	0.290	1520	a	a	a	a
Chloride	mg/L	2.00	4.27	18.9	881	3.34	1140	5.16	6.51
Conductivity	μmhos/cm	350	238	1400	18400	5180	5060	3070	1250
Copper	mg/L	a	a	a	a	a	0.05	0.55	a
Fluoride	mg/L	0.04	1.29	a	69.00	a	0.086	a	0.158
Hydroxide	mg/L	0.012	0.008	0.012	25.388	0.000	0.000	0.000	0.000
Iron	mg/L	0.09	1.66	0.99	0.14	51.50	30.5	141	2.98
Lithium	mg/L	a	0.06	0.08	51.5	0.08	3.59	0.11	0.05
Magnesium	mg/L	0.13	0.12	0.83	a	21.4	8.05	64.00	13.2
Manganese	mg/L	0.06	a	0.46	a	1.44	1.16	4.28	3.02
Mercury	mg/L	a	0.00109	0.00438	a	a	0.00115	a	0.00067
pH	pH units	7.84	7.65	7.86	11.17	2.00	2.40	2.50	4.94
Potassium	mg/L	2.33	7.19	80.00	270	32.5	115	24.2	30.3
Selenium	mg/L	0.05	1.41	0.05	1.92	a	0.903	a	a
Silica	mg/L	84.2	118	125	3340	277	316	241	263
Sodium	mg/L	54.8	41.9	163	3860	37	720	41.00	108
Strontium	mg/L	0.33	a	1.36	0.89	0.08	0.16	0.06	0.20
Sulfate	mg/L	98.3	63.3	532	1510	1110	478	1880	557
TDS	mg/L	327	429	1460	14900	1640	2980	2930	1160
Thallium	mg/L	a	a	a	0.04	a	a	a	a
Zinc	mg/L	a	0.15	0.35	2.76	0.14	0.15	1.34	0.12

^a None detected.

TEMPERATURE RECORDINGS OF THE COSO RESORT AREA WELLS

The temperature logs from Wells 4K-1, 4P-1, and Coso No. 1 are graphed in Figure 21, with the data listed in Tables 8 through 10. These data were recorded using the TD Probe System, manufactured by Natural Progress Instruments, Dallas, Texas.

TABLE 8. Temperature Recordings at Well 4K-1.

Depth, ft	Elevation, ft AMSL	Temperature °F on 12/06/96
0	3658	206.0
-5	3653	206.0
-10	3648	206.0
-15	3643	206.0
-20	3638	206.0
-25	3633	206.0
-30	3628	206.0
-35	3623	206.0
-40	3618	206.0
-45	3613	206.0
-50	3608	206.0
-51	3607	206.0
-52	3606	206.0
-53	3605	207.9
-54	3604	208.9
-55	3603	208.9
-60	3598	211.0
-65	3593	211.0
-70	3588	211.0
-75	3583	212.1
-80	3578	212.1

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TABLE 9. Temperature Recordings at Well 4P-1.

Depth, ft	Elevation, ft AMSL	Temperature °F on 12/6/96
0	3662	195.7
-5	3657	205.8
-10	3652	205.8
-15	3647	205.8
-20	3642	205.8
-25	3637	205.8
-30	3632	205.8
-35	3627	205.8
-40	3622	205.8
-45	3617	205.8
-50	3612	205.8
-51	3611	205.8
-52	3610	206.9
-53	3609	207.9
-54	3608	207.9
-55	3607	208.9
-56	3606	211.0
-57	3605	211.0
-58	3604	212.1
-59	3603	212.1
-60	3602	213.2
-65	3597	219.0
-70	3592	222.8
-75	3587	222.8
-80	3582	224.2
-85	3577	225.5
-90	3572	226.9
-95	3567	234.7
-100	3562	239.9
-102	3560	243.7
-105	3557	249.9

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TABLE 10. Temperature Recordings at Coso No. 1.

Depth, ft	Elevation, ft AMSL	Temperature °F on 12/6/96
0	3615	251.5
-10	3605	251.5
-20	2595	251.5
-30	2585	252.0
-40	2575	252.0
-50	2565	252.0
-60	2555	252.0
-70	2545	252.0
-80	2535	252.1
-90	2525	252.1
-100	2515	252.1
-110	2505	252.1
-120	2495	252.1
-130	2485	252.2
-140	2475	252.2
-150	2465	252.2
-160	2455	252.2
-170	2445	252.2
-180	2435	252.2
-190	2425	252.3
-200	2415	252.3
-210	2405	252.3
-220	2395	252.3
-230	2385	252.4
-240	2375	252.4
-250	2365	252.4
-260	2355	252.4
-270	2345	252.4
-280	2335	252.4
-290	2325	252.4
-300	2315	252.4
-305	2310	252.4
-310	2305	252.4
-315	2300	252.4
-320	2295	255.8
-321	2294	257.3
-322	2293	257.7
-323	2292	258.8
-324	2291	259.0
-325	2290	259.4
-326	2289	259.6
-327	2288	259.9
-328	2287	260.1
-329	2286	260.1
-330	2285	260.7
-331	2284	261.0
-332	2283	261.3
-335	2282	261.9
-340	2281	263.0
-345	2276	264.3
-350	2271	264.9
-355	2266	265.4
-356	2267	265.8

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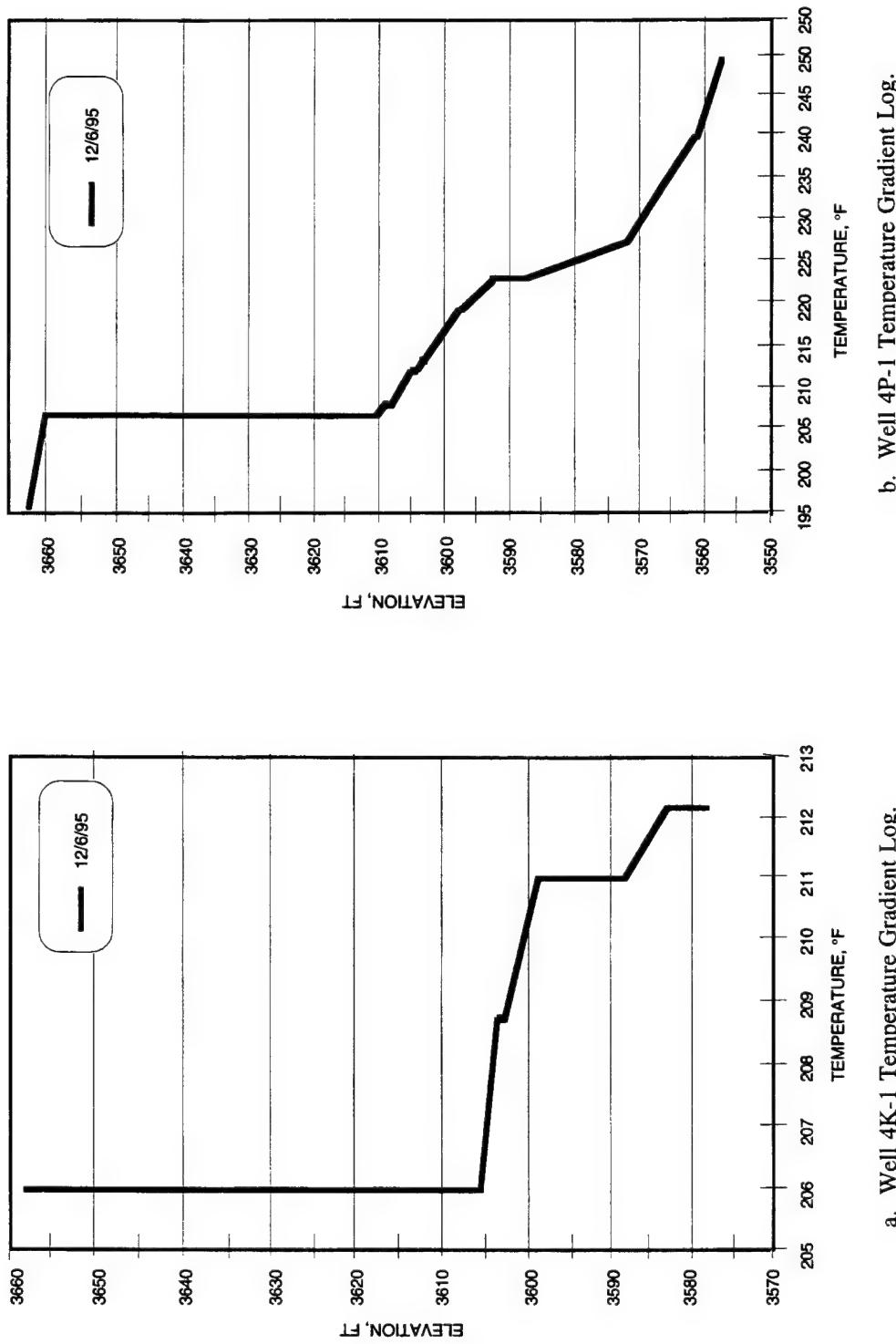
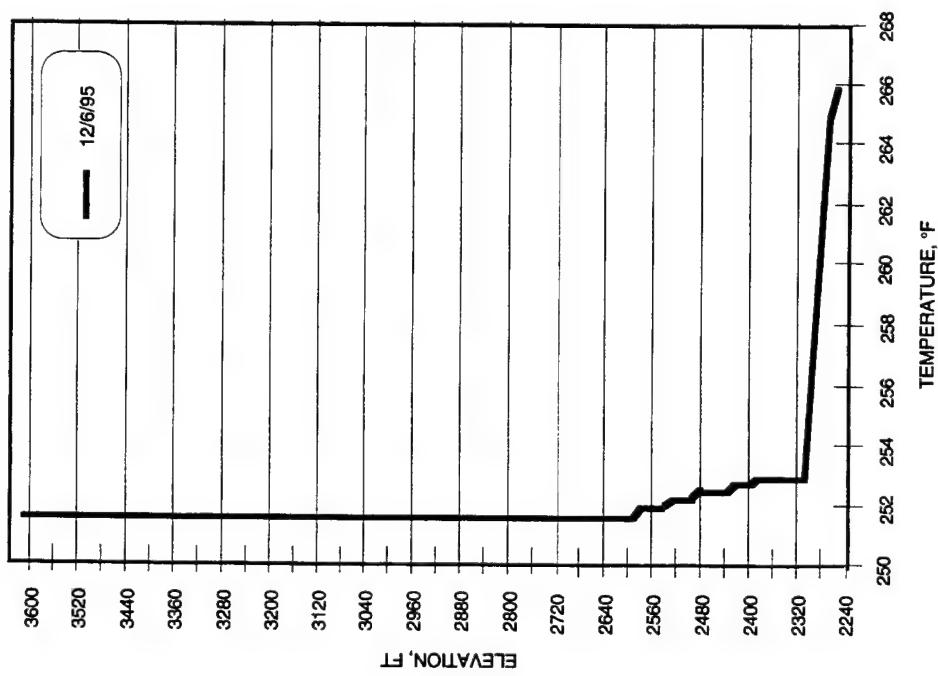


FIGURE 21. Temperature Profiles.

a. Well 4K-1 Temperature Gradient Log.

b. Well 4P-1 Temperature Gradient Log.

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c. Coso No. 1 Temperature Gradient Log.

FIGURE 21. (Contd.)

OTHER GEOTHERMAL ACTIVITY AT COSO HOT SPRINGS

WEST CANYONS

The two west canyons are located approximately 0.7 km west of the Coso Resort area and on a course perpendicular to the strike-slip fault that runs north and south through the Coso Hot Springs area (Figure 1).

The southerly canyon (Figure 9), which has rain station No. 2 located at the west end, consists of hydrothermal alteration and scattered thermal activity both in the canyon and a wide area at the mouth of the canyon. The geology of this canyon indicates an extensive period of thermal activity, as well as historic fluctuation of these thermal features. The prominent area of activity in the canyon includes an active steam vent bordering a vigorously boiling pool. At a greater distance up the canyon are two diminutive steam vents, small springs and fossil hot spring terrace deposits. Thermal activity in these areas is sporadic, depending upon climatic conditions. No notable changes in the level of thermal activity have occurred here during this reporting period.

The northerly west canyon (Figures 10, 11) holds an extensive area of hydrothermal alteration and fossil hot spring deposits. Present thermal activity is limited to warm-to-hot ground with a small number of steam vents. The earth slump, first noted in NAWS-CL TP 001, has continued to stabilize during the past year. Much of the slump area is warm-to-hot, with steam emanating from multiple vents, specifically along the face of the slump. The small pools of mud and steam condense, noted in last years summary, are still present to the west of the slump.

One of the indicators of newly heated ground is the die-off of vegetation. The distribution of plant life in these canyons has stayed essentially unchanged. As a whole, these sites appear to be unchanged from last year.

DISCUSSION AND SUMMARY

The data recovered from each of the steam flow monitoring sites: Devils Kitchen, Well 4H-4, and Schober's Resort are considerably less erratic this year than the data recovered in the past several years. This may be due to the new recording equipment and a formal periodic maintenance and calibration schedule, although this apparent stability could also be due to a stabilization of the thermal flux in the hot springs area. Continued monitoring of these sites may better define this issue.

The water level in well 4P-1 slowly continues to rise—about 21 feet since the beginning of the monitoring program in 1978. Most of this water level rise has occurred since 1989. The water in this well is predominately a steam condensate and probably represents a small perched water table.

In contrast to well 4P-1, the water level in well OB-1 continues to drop slightly. Well OB-1 is located adjacent to the south side of Coso Wash and is clearly set in valley fill sediments, so it is unclear why the level has dropped some 40 feet since 1988. While water analyses indicate a partial geothermal fluid component, the predominant water source is clearly inflow of meteoric water from the mountains to the north and east. The groundwater around well OB-1 may still be responding to relatively low rainfall conditions in the region from 1985 through 1990, or the groundwater may just be seeking equilibrium with groundwater on the north side of the wash (represented by well OB-2).

As discussed in previous monitoring reports, the water level in Coso No. 1 is clearly influenced by the thermal activity along the hot springs fault. The level has dropped about 175 feet since 1984 due to a significant influx of heat and boiling-off of water. Since the wellhead was repaired and the well shut in, the water level appears to have stabilized.

There has been no significant change in thermal activity at the South Pool this past year. The water level continues to fluctuate seasonally, as does the water temperature, which exhibits about a fifteen degree (F) seasonal variation.

Additional observations:

During this reporting period, the central Coso Fault thermal area has remained very stable. The thermal area includes the old corrosion array, the Coso Resort mudfield, the South Pool, and the smaller pool and pots in between. No new mud pots have appeared here and the existing mud pots, craters, and fumaroles have not changed in appearance.

The surface ground temperatures at previously recognized hot spots both around the Upper Coso Wash Valley and along the periphery of the Coso Fault system have remained stable during the monitoring period. A hot spot is identified by warm-to-hot near-surface temperatures, discolored (cooked) soil, and/or die-off of vegetation. The shallow-rooted grasses, scrubs and deep-rooted creosote bushes that grew in these hot spots have remained the same since the last monitoring period. Some specific vegetation recovery areas are: along the fault line North of

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Schober's Resort, in the northerly west canyon, around and south of well 4P-1, and in several areas in the valley east of Schober's Resort.

This year's data, particularly data obtained from the surface pools, pots, fumaroles, and hot spots, indicate seasonal fluctuation in temperatures and water levels; however, no significant increase or decrease of activity is occurring or has occurred during this monitoring period. Continuance of this monitoring program will enable us to determine if this stable trend continues.

REFERENCES

1. Naval Air Weapons Station. *Coso Monitoring Program, October 1993 Through September 1994*, by S. C. Bjornstad, Public Works Department, J. H. Monahan, J. K. Sprouse and D. M. White, Comarco Weapons Support Division, Ridgecrest, Calif. China Lake, Calif., NAWS-CL, January 1995. 106 pp. (NAWS-CL TP 006, publication UNCLASSIFIED.)
2. _____. *Coso Monitoring Program, October 1991 Through September 1992*, by J. H. Monahan and K. L. Larson, Comarco Weapons Support Division, Ridgecrest, Calif. China Lake, Calif., NAWS-CL, December 1992. 123 pp. (NAWS-CL TP 001, publication UNCLASSIFIED.)

Appendix

DAILY STEAM FLOW

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Devil's Kitchen Steam Flow 10/95 through 9/96				Well 4H-4 Steam Flow 10/95 through 9/96				Schober's Steam Flow 10/95 through 9/96			
DATE	High, lb/h	Low, lb/h	Avg, lb/h	DATE	High, lb/h	Low, lb/h	Avg, lb/h	DATE	High, lb/h	Low, lb/h	Avg, lb/h
10/01/95	511	492	498	10/01/95	296	278	283	10/01/95	930	919	926
10/02/95	509	481	494	10/02/95	288	270	278	10/02/95	935	924	929
10/03/95	529	497	515	10/03/95	333	279	304	10/03/95	960	930	941
10/04/95	519	480	496	10/04/95	323	269	290	10/04/95	953	925	934
10/05/95	504	482	493	10/05/95	275	262	268	10/05/95	929	922	925
10/06/95	524	496	509	10/06/95	310	272	289	10/06/95	937	921	929
10/07/95	515	496	507	10/07/95	304	279	297	10/07/95	936	929	934
10/08/95	508	490	498	10/08/95	291	274	281	10/08/95	940	929	934
10/09/95	500	487	494	10/09/95	285	270	280	10/09/95	939	930	934
10/10/95	529	480	490	10/10/95	283	267	275	10/10/95	939	927	932
10/11/95	508	493	499	10/11/95	300	281	290	10/11/95	938	927	932
10/12/95	502	481	495	10/12/95	299	277	292	10/12/95	938	929	934
10/13/95	489	469	478	10/13/95	278	261	269	10/13/95	933	924	929
10/14/95	491	474	481	10/14/95	282	263	270	10/14/95	931	924	928
10/15/95	508	484	494	10/15/95	300	274	285	10/15/95	940	924	932
10/16/95	502	492	497	10/16/95	303	292	299	10/16/95	940	933	938
10/17/95	495	474	488	10/17/95	292	282	286	10/17/95	945	931	937
10/18/95	496	481	489	10/18/95	286	277	283	10/18/95	945	933	938
10/19/95	482	464	473	10/19/95	277	259	265	10/19/95	938	926	932
10/20/95	496	470	483	10/20/95	297	259	278	10/20/95	938	926	930
10/21/95	517	493	498	10/21/95	348	295	320	10/21/95	960	931	944
10/22/95	508	467	474	10/22/95	332	265	283	10/22/95	953	913	925
10/23/95	485	464	473	10/23/95	280	262	269	10/23/95	922	913	917
10/24/95	491	469	481	10/24/95	282	272	275	10/24/95	922	910	917
10/25/95	494	479	484	10/25/95	289	277	281	10/25/95	926	912	919
10/26/95	499	482	490	10/26/95	299	279	288	10/26/95	940	919	928
10/27/95	500	488	495	10/27/95	303	293	296	10/27/95	946	933	939
10/28/95	499	491	495	10/28/95	299	292	296	10/28/95	946	939	945
10/29/95	495	481	490	10/29/95	296	283	291	10/29/95	946	939	944
10/30/95	495	477	486	10/30/95	299	281	287	10/30/95	946	939	945
10/31/95	495	480	490	10/31/95	337	290	296	10/31/95	946	937	946
11/01/95	491	472	480	11/01/95	296	263	280	11/01/95	951	941	946
11/02/95	478	467	473	11/02/95	274	258	265	11/02/95	948	939	944
11/03/95	484	471	478	11/03/95	282	261	270	11/03/95	948	939	944
11/04/95	485	476	481	11/04/95	281	269	274	11/04/95	948	939	944
11/05/95	498	478	486	11/05/95	293	269	280	11/05/95	950	939	944
11/06/95	494	472	484	11/06/95	292	257	280	11/06/95	948	939	945
11/07/95	522	462	474	11/07/95	294	244	254	11/07/95	943	932	936
11/08/95	502	477	489	11/08/95	300	259	279	11/08/95	975	939	956
11/09/95	521	471	489	11/09/95	334	299	314	11/09/95	975	939	956

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Devil's Kitchen Steam Flow 10/95 through 9/96				Well 4H-4 Steam Flow 10/95 through 9/96				Schober's Steam Flow 10/95 through 9/96			
DATE	High, lb/h	Low, lb/h	Avg, lb/h	DATE	High, lb/h	Low, lb/h	Avg, lb/h	DATE	High, lb/h	Low, lb/h	Avg, lb/h
11/10/95	505	460	478	11/10/95	313	237	273	11/10/95	970	927	948
11/11/95	485	460	472	11/11/95	262	235	248	11/11/95	936	925	931
11/12/95	493	479	485	11/12/95	283	260	268	11/12/95	945	927	935
11/13/95	495	479	486	11/13/95	284	265	272	11/13/95	945	932	936
11/14/95	503	479	487	11/14/95	305	279	289	11/14/95	966	934	946
11/15/95	497	479	487	11/15/95	292	279	287	11/15/95	954	945	950
11/16/95	491	478	485	11/16/95	279	262	273	11/16/95	952	945	947
11/17/95	492	475	483	11/17/95	267	258	263	11/17/95	947	938	944
11/18/95	497	479	487	11/18/95	290	264	275	11/18/95	950	938	944
11/19/95	497	480	487	11/19/95	290	271	282	11/19/95	950	941	946
11/20/95	491	475	483	11/20/95	272	259	265	11/20/95	947	938	944
11/21/95	503	478	490	11/21/95	294	264	273	11/21/95	951	936	952
11/22/95	492	478	487	11/22/95	280	277	279	11/22/95	956	945	950
11/23/95	491	478	485	11/23/95	278	263	269	11/23/95	949	938	945
11/24/95	496	478	487	11/24/95	271	263	266	11/24/95	949	938	943
11/25/95	503	484	493	11/25/95	300	267	283	11/25/95	956	940	948
11/26/95	502	483	487	11/26/95	313	271	293	11/26/95	954	940	948
11/27/95	491	478	487	11/27/95	275	258	266	11/27/95	945	931	936
11/28/95	492	478	487	11/28/95	309	257	262	11/28/95	943	929	936
11/29/95	500	484	493	11/29/95	271	256	262	11/29/95	942	931	936
11/30/95	503	489	496	11/30/95	290	268	279	11/30/95	945	933	938
12/01/95	503	484	493	12/01/95	306	285	292	12/01/95	951	938	942
12/02/95	496	483	489	12/02/95	289	257	274	12/02/95	945	931	941
12/03/95	497	484	490	12/03/95	271	254	260	12/03/95	942	931	935
12/04/95	500	484	493	12/04/95	281	261	268	12/04/95	945	931	937
12/05/95	497	484	487	12/05/95	284	267	274	12/05/95	947	931	939
12/06/95	497	487	492	12/06/95	276	270	273	12/06/95	945	933	940
12/07/95	503	489	496	12/07/95	284	259	278	12/07/95	945	933	940
12/08/95	496	484	487	12/08/95	260	253	256	12/08/95	942	931	936
12/09/95	496	483	482	12/09/95	262	248	254	12/09/95	938	926	932
12/10/95	497	483	489	12/10/95	269	247	257	12/10/95	938	926	931
12/11/95	497	489	493	12/11/95	285	267	276	12/11/95	938	931	933
12/12/95	497	479	487	12/12/95	299	283	283	12/12/95	947	933	934
12/13/95	491	478	485	12/13/95	287	271	282	12/13/95			
12/14/95	492	475	483	12/14/95	284	239	253	12/14/95			
12/15/95	497	479	487	12/15/95	303	240	273	12/15/95			
12/16/95	497	480	487	12/16/95	303	278	296	12/16/95			
12/17/95	491	475	483	12/17/95	281	276	279	12/17/95			
12/18/95	503	478	490	12/18/95	279	275	277	12/18/95			
12/19/95	492	478	487	12/19/95	287	274	279	12/19/95			
12/20/95	491	478	485	12/20/95	295	277	286	12/20/95			
12/21/95	496	478	487	12/21/95	281	267	276	12/21/95			

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Devil's Kitchen Steam Flow 10/95 through 9/96				Well 4H-4 Steam Flow 10/95 through 9/96				Schoobar's Steam Flow 10/95 through 9/96			
DATE	High, lb/h	Low, lb/h	Avg, lb/h	DATE	High, lb/h	Low, lb/h	Avg, lb/h	DATE	High, lb/h	Low, lb/h	Avg, lb/h
12/22/95	503	484	493	12/22/95	275	265	269	12/22/95	275	269	275
12/23/95	502	483	487	12/23/95	285	269	275	12/23/95	270	262	267
12/24/95	491	478	487	12/24/95	270	262	272	12/24/95	285	264	272
12/25/95	500	484	493	12/25/95	285	277	283	12/25/95	292	277	283
12/26/95	500	488	493	12/26/95	292	277	283	12/26/95	303	285	291
12/27/95	501	488	494	12/27/95	303	281	296	12/27/95	303	281	296
12/28/95	498	486	491	12/28/95	281	276	284	12/28/95	295	276	284
12/29/95	497	488	493	12/29/95	295	288	293	12/29/95	305	295	293
12/30/95	503	484	493	12/30/95	295	288	293	12/30/95	319	298	303
12/31/95	499	483	491	12/31/95	319	283	298	12/31/95	319	291	298
01/01/96	496	484	491	01/01/96	291	277	284	01/01/96	291	277	284
01/02/96	500	488	494	01/02/96	289	277	284	01/02/96	299	277	284
01/03/96	509	500	505	01/03/96	334	280	309	01/03/96	334	280	309
01/04/96	508	488	499	01/04/96	331	290	315	01/04/96	331	290	315
01/05/96	496	485	491	01/05/96	291	262	284	01/05/96	291	262	284
01/06/96	491	479	485	01/06/96	264	251	260	01/06/96	264	251	260
01/07/96	501	483	490	01/07/96	296	261	277	01/07/96	296	261	277
01/08/96	503	489	495	01/08/96	302	292	297	01/08/96	302	292	297
01/09/96	503	485	494	01/09/96	311	296	302	01/09/96	311	296	302
01/10/96	493	479	485	01/10/96	305	264	282	01/10/96	305	264	282
01/11/96	495	480	487	01/11/96	283	262	271	01/11/96	283	262	271
01/12/96	508	488	499	01/12/96	316	280	297	01/12/96	316	280	297
01/13/96	498	485	492	01/13/96	321	307	311	01/13/96	321	307	311
01/14/96	507	488	496	01/14/96	309	295	301	01/14/96	309	295	301
01/15/96	497	484	491	01/15/96	324	293	306	01/15/96	324	293	306
01/16/96	492	479	486	01/16/96	362	318	336	01/16/96	362	318	336
01/17/96	494	480	487	01/17/96	360	269	315	01/17/96	360	269	315
01/18/96	498	479	491	01/18/96	299	265	278	01/18/96	299	265	278
01/19/96	497	478	489	01/19/96	310	271	298	01/19/96	310	271	298
01/20/96	495	478	487	01/20/96	280	257	268	01/20/96	280	257	268
01/21/96	504	487	494	01/21/96	329	280	312	01/21/96	329	280	312
01/22/96	503	485	494	01/22/96	325	265	297	01/22/96	325	265	297
01/23/96	493	479	485	01/23/96	273	255	264	01/23/96	273	255	264
01/24/96	495	480	487	01/24/96	316	273	296	01/24/96	316	273	296
01/25/96	508	488	499	01/25/96	328	284	319	01/25/96	328	284	319
01/26/96	498	485	492	01/26/96	284	269	274	01/26/96	284	269	274
01/27/96	510	490	500	01/27/96	322	273	301	01/27/96	322	273	301
01/28/96	503	489	497	01/28/96	321	290	300	01/28/96	321	290	300
01/29/96	509	495	499	01/29/96	310	291	298	01/29/96	310	291	298
01/30/96	508	495	502	01/30/96	313	298	305	01/30/96	313	298	305
01/31/96	508	498	503	01/31/96	334	311	320	01/31/96	334	311	320
02/01/96	510	500	505	02/01/96	329	303	317	02/01/96	329	303	317

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Devils Kitchen Steam Flow 10/95 through 9/96				Well 4H-4 Steam Flow 10/95 through 9/96				Schober's Steam Flow 10/95 through 9/96			
DATE	High, lb/h	Low, lb/h	Avg, lb/h	DATE	High, lb/h	Low, lb/h	Avg, lb/h	DATE	High, lb/h	Low, lb/h	Avg, lb/h
02/02/96	507	488	496	02/02/96	303	260	287	02/02/96	976	967	968
02/03/96	497	484	491	02/03/96	266	248	258	02/03/96	976	967	968
02/04/96	503	489	496	02/04/96	282	256	267	02/04/96	973	967	967
02/05/96	506	492	500	02/05/96	286	269	275	02/05/96	976	967	968
02/06/96	509	495	500	02/06/96	295	274	282	02/06/96	976	967	968
02/07/96	513	501	508	02/07/96	318	287	300	02/07/96	974	968	968
02/08/96	520	505	512	02/08/96	328	299	311	02/08/96	974	968	968
02/09/96	519	507	513	02/09/96	321	307	316	02/09/96	973	967	967
02/10/96	514	502	507	02/10/96	308	283	296	02/10/96	973	967	967
02/11/96	515	500	506	02/11/96	301	281	287	02/11/96	973	967	967
02/12/96	514	501	507	02/12/96	305	279	292	02/12/96	973	967	967
02/13/96	516	501	507	02/13/96	305	277	288	02/13/96	973	967	967
02/14/96	515	503	508	02/14/96	297	289	291	02/14/96	973	964	965
02/15/96				02/15/96				02/15/96	973	964	965
02/16/96				02/16/96				02/16/96	956	961	961
02/17/96				02/17/96				02/17/96	956	962	962
02/18/96				02/18/96				02/18/96	989	964	972
02/19/96				02/19/96				02/19/96	970	951	958
02/20/96				02/20/96				02/20/96	957	939	945
02/21/96	510	505	505	02/21/96	309	294	319	02/21/96	946	936	939
02/22/96	514	491	505	02/22/96	313	250	288	02/22/96	941	936	936
02/23/96	519	492	505	02/23/96	307	248	275	02/23/96	941	929	933
02/24/96	532	512	521	02/24/96	361	306	336	02/24/96	937	928	929
02/25/96	529	512	520	02/25/96	347	324	334	02/25/96	937	928	929
02/26/96	520	502	507	02/26/96	330	278	304	02/26/96	941	928	931
02/27/96	514	502	507	02/27/96	291	277	283	02/27/96	943	934	936
02/28/96	514	500	506	02/28/96	288	268	279	02/28/96	949	936	940
02/29/96	509	497	503	02/29/96	274	260	268	02/29/96	934	920	925
03/01/96	514	498	494	03/01/96	292	260	274	03/01/96	929	920	922
03/02/96	515	504	510	03/02/96	326	288	308	03/02/96	937	922	928
03/03/96	526	512	518	03/03/96	339	318	328	03/03/96	941	928	933
03/04/96	526	510	517	03/04/96	342	324	337	03/04/96	945	936	937
03/05/96	529	512	520	03/05/96	355	315	330	03/05/96	945	936	937
03/06/96	508	489	499	03/06/96	315	277	292	03/06/96	945	928	934
03/07/96	515	497	505	03/07/96	325	277	301	03/07/96	934	923	925
03/08/96	521	505	513	03/08/96	346	316	329	03/08/96	937	920	926
03/09/96	518	507	512	03/09/96	342	327	335	03/09/96	941	931	934
03/10/96	521	508	514	03/10/96	358	334	343	03/10/96	938	920	926
03/11/96	520	509	515	03/11/96	366	334	351	03/11/96	934	914	920
03/12/96	526	512	520	03/12/96	397	364	381	03/12/96	918	905	908
03/13/96	504	494	499	03/13/96	397	337	377	03/13/96	918	905	908
03/14/96	504	499	499	03/14/96	337	308	325	03/14/96	926	912	915

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Devils Kitchen Steam Flow 10/95 through 9/96				Well 4H-4 Steam Flow 10/95 through 9/96				Schober's Steam Flow 10/95 through 9/96			
DATE	High, lb/h	Low, lb/h	Avg, lb/h	DATE	High, lb/h	Low, lb/h	Avg, lb/h	DATE	High, lb/h	Low, lb/h	Avg, lb/h
03/15/96	520	495	506	03/15/96	349	308	327	03/15/96	941	925	929
03/15/96	524	507	514	03/16/96	362	336	347	03/16/96	941	929	934
03/17/96	526	507	516	03/17/96	381	337	357	03/17/96	943	931	936
03/18/96	516	501	509	03/18/96	368	347	358	03/18/96	943	931	934
03/19/96	514	500	507	03/19/96	374	355	362	03/19/96	957	920	936
03/20/96	519	499	509	03/20/96	392	362	371	03/20/96	946	937	931
03/21/96	530	514	520	03/21/96	406	373	386	03/21/96	946	937	939
03/22/96	532	513	523	03/22/96	409	392	404	03/22/96	949	928	936
03/23/96	522	500	510	03/23/96	407	342	377	03/23/96	941	926	928
03/24/96	520	499	510	03/24/96	371	338	350	03/24/96	932	904	915
03/25/96	530	489	514	03/25/96	405	328	370	03/25/96	947	885	925
03/26/96	516	489	505	03/26/96	355	325	338	03/26/96	931	885	908
03/27/96	529	504	516	03/27/96	394	352	372	03/27/96	943	920	931
03/28/96	534	501	522	03/28/96	420	353	393	03/28/96	965	923	945
03/29/96	517	507	512	03/29/96	353	329	337	03/29/96	932	919	926
03/30/96	543	507	516	03/30/96	364	335	346	03/30/96	940	925	931
03/31/96	546	507	513	03/31/96	381	353	363	03/31/96	948	931	937
04/01/96	532	506	510	04/01/96	392	368	378	04/01/96	958	937	943
04/02/96	517	501	510	04/02/96	383	351	368	04/02/96	958	939	949
04/03/96	532	496	516	04/03/96	368	342	353	04/03/96	951	940	947
04/04/96	514	489	502	04/04/96	344	321	333	04/04/96	944	916	926
04/05/96	515	495	505	04/05/96	351	328	335	04/05/96	928	906	920
04/06/96	521	501	510	04/06/96	394	335	361	04/06/96	949	921	935
04/07/96	523	507	516	04/07/96	397	373	381	04/07/96	966	942	952
04/08/96	526	507	513	04/08/96	375	355	367	04/08/96	961	948	957
04/09/96	526	507	516	04/09/96	390	352	368	04/09/96	961	948	954
04/10/96	534	502	523	04/10/96	404	376	386	04/10/96	969	947	955
04/11/96	530	500	516	04/11/96	377	339	359	04/11/96	951	912	930
04/12/96	529	498	513	04/12/96	404	356	377	04/12/96	957	931	940
04/13/96	518	500	507	04/13/96	356	339	346	04/13/96	931	915	922
04/14/96	510	495	505	04/14/96	352	330	340	04/14/96	921	902	915
04/15/96	525	501	512	04/15/96	401	345	369	04/15/96	942	910	925
04/16/96	526	507	516	04/16/96	400	373	390	04/16/96	938	920	931
04/17/96	532	507	525	04/17/96	376	355	372	04/17/96	935	915	922
04/18/96	523	495	510	04/18/96	358	324	348	04/18/96	922	902	916
04/19/96	523	495	507	04/19/96	378	321	344	04/19/96	925	902	911
04/20/96	521	502	513	04/20/96	383	369	375	04/20/96	923	908	917
04/21/96	520	501	510	04/21/96	381	344	369	04/21/96	926	912	919
04/22/96	514	500	510	04/22/96	352	333	341	04/22/96	922	907	915
04/23/96	521	501	510	04/23/96	372	340	351	04/23/96	925	906	915
04/24/96	526	498	516	04/24/96	394	359	368	04/24/96	936	919	921
04/25/96	520	498	513	04/25/96	370	347	358	04/25/96	950	924	933

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Devil's Kitchen Steam Flow 10/95 through 9/96				Well 4H-4 Steam Flow 10/95 through 9/96				Schober's Steam Flow 10/95 through 9/96			
DATE	High, lb/h	Low, lb/h	Avg, lb/h	DATE	High, lb/h	Low, lb/h	Avg, lb/h	DATE	High, lb/h	Low, lb/h	Avg, lb/h
04/26/96	530	501	516	04/26/96	385	347	369	04/26/96	956	930	939
04/27/96	526	507	513	04/27/96	394	370	382	04/27/96	955	932	944
04/28/96	514	495	505	04/28/96	370	323	341	04/28/96	936	891	909
04/29/96	526	496	507	04/29/96	366	320	339	04/29/96	927	901	910
04/30/96	526	507	516	04/30/96	396	359	374	04/30/96	937	913	924
05/01/96	531	498	510	05/01/96	379	371	375	05/01/96	934	926	928
05/02/96	526	496	509	05/02/96	387	377	396	05/02/96	945	942	952
05/03/96	529	507	513	05/03/96	393	365	378	05/03/96	959	940	945
05/04/96	520	502	510	05/04/96	371	350	360	05/04/96	946	926	937
05/05/96	523	497	510	05/05/96	378	348	358	05/05/96	945	926	933
05/06/96	526	507	516	05/06/96	389	360	370	05/06/96	953	928	937
05/07/96	525	507	513	05/07/96	381	363	371	05/07/96	946	931	939
05/08/96	520	507	513	05/08/96	363	359	360	05/08/96	937	926	931
05/09/96	516	494	505	05/09/96	284	262	280	05/09/96	931	926	929
05/10/96	519	500	505	05/10/96	285	262	280	05/10/96	929	924	926
05/11/96	517	501	509	05/11/96	281	272	275	05/11/96	931	926	928
05/12/96	519	496	507	05/12/96	287	275	281	05/12/96	944	930	936
05/13/96	520	501	510	05/13/96	302	286	292	05/13/96	947	940	943
05/14/96	526	507	516	05/14/96	303	293	296	05/14/96	944	941	942
05/15/96	526	509	516	05/15/96	295	290	293	05/15/96	942	935	939
05/16/96	520	507	513	05/16/96	293	287	290	05/16/96	936	929	932
05/17/96	517	501	510	05/17/96	292	283	287	05/17/96	934	929	931
05/18/96	520	501	511	05/18/96	292	282	285	05/18/96	935	928	931
05/19/96	517	501	510	05/19/96	296	285	290	05/19/96	937	929	932
05/20/96	516	499	507	05/20/96	295	286	290	05/20/96	936	931	933
05/21/96	515	503	509	05/21/96	290	283	286	05/21/96	936	933	934
05/22/96	523	496	509	05/22/96	293	287	290	05/22/96	942	928	935
05/23/96	525	497	511	05/23/96	300	286	292	05/23/96	941	923	929
05/24/96	519	501	510	05/24/96	299	282	287	05/24/96	932	923	926
05/25/96	518	501	509	05/25/96	295	285	291	05/25/96	930	922	926
05/26/96	517	500	509	05/26/96	289	280	285	05/26/96	936	925	929
05/27/96	520	489	505	05/27/96	292	280	286	05/27/96	946	928	936
05/28/96	508	488	498	05/28/96	306	286	295	05/28/96	937	925	930
05/29/96	518	497	507	05/29/96	293	280	286	05/29/96	943	935	938
05/30/96	514	501	507	05/30/96	298	290	293	05/30/96	942	937	938
05/31/96	511	499	505	05/31/96	292	283	289	05/31/96	938	934	936
06/01/96	517	504	510	06/01/96	287	280	283	06/01/96	936	933	935
06/02/96	518	492	503	06/02/96	282	276	279	06/02/96	941	933	936
06/03/96	514	495	505	06/03/96	286	276	280	06/03/96	950	939	943
06/04/96	513	500	506	06/04/96	296	282	288	06/04/96	956	947	951
06/05/96	520	502	508	06/05/96	300	290	295	06/05/96	954	942	947
06/06/96	520	500	507	06/06/96	298	290	294	06/06/96	945	939	942

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Devils Kitchen Steam Flow 10/95 through 9/96				Well 4H-4 Steam Flow 10/95 through 9/96				Schober's Steam Flow 10/95 through 9/96			
DATE	High, lb/h	Low, lb/h	Avg, lb/h	DATE	High, lb/h	Low, lb/h	Avg, lb/h	DATE	High, lb/h	Low, lb/h	Avg, lb/h
06/07/96	519	501	510	06/07/96	294	286	290	06/07/96	942	936	939
06/08/96	519	495	505	06/08/96	292	283	288	06/08/96	940	935	938
06/09/96	514	501	507	06/09/96	290	285	288	06/09/96	942	936	938
06/10/96	514	500	507	06/10/96	296	287	291	06/10/96	947	935	939
06/11/96	516	500	508	06/11/96	300	287	292	06/11/96	946	938	941
06/12/96	520	503	509	06/12/96	298	292	294	06/12/96	943	937	940
06/13/96				06/13/96	294	288	291	06/13/96	940	935	937
06/14/96				06/14/96	292	285	287	06/14/96	941	935	937
06/15/96				06/15/96	293	285	288	06/15/96	942	935	938
06/16/96				06/16/96	294	288	290	06/16/96	939	934	936
06/17/96				06/17/96	293	285	289	06/17/96	939	930	934
06/18/96				06/18/96	292	282	286	06/18/96	940	933	935
06/19/96				06/19/96	295	285	288	06/19/96	940	932	936
06/20/96				06/20/96	294	287	289	06/20/96	941	932	935
06/21/96				06/21/96	298	285	290	06/21/96	945	937	940
06/22/96				06/22/96	300	288	294	06/22/96	938	929	934
06/23/96				06/23/96	288	282	285	06/23/96	940	933	935
06/24/96				06/24/96	292	281	286	06/24/96	941	933	936
06/25/96				06/25/96	295	286	289	06/25/96	935	933	934
06/26/96	506	495	501	06/26/96	290	286	287	06/26/96	933	922	926
06/27/96	504	489	497	06/27/96	289	281	286	06/27/96	923	917	920
06/28/96	504	484	494	06/28/96	286	276	281	06/28/96	920	916	918
06/29/96	503	489	496	06/29/96	280	274	276	06/29/96	927	917	921
06/30/96	507	489	499	06/30/96	289	275	281	06/30/96	932	925	927
07/01/96	508	491	501	07/01/96	290	283	285	07/01/96	939	927	931
07/02/96	508	491	500	07/02/96	293	280	286	07/02/96	945	935	938
07/03/96	508	487	499	07/03/96	298	288	291	07/03/96	941	938	940
07/04/96	512	495	504	07/04/96	289	280	289	07/04/96	948	936	940
07/05/96	507	492	500	07/05/96	296	286	290	07/05/96	945	939	941
07/06/96	504	491	499	07/06/96	293	285	288	07/06/96	946	937	941
07/07/96	508	492	502	07/07/96	289	281	285	07/07/96	948	941	944
07/08/96	508	494	502	07/08/96	296	283	288	07/08/96	949	943	945
07/09/96	503	489	496	07/09/96	295	288	291	07/09/96	945	941	943
07/10/96	503	486	494	07/10/96	288	280	284	07/10/96	942	938	940
07/11/96	506	488	495	07/11/96	287	275	279	07/11/96	943	933	938
07/12/96	503	488	496	07/12/96	288	275	281	07/12/96	941	932	936
07/13/96	506	489	498	07/13/96	292	280	285	07/13/96	942	938	940
07/14/96	503	491	497	07/14/96	293	285	287	07/14/96	947	939	943
07/15/96	507	489	499	07/15/96	290	285	288	07/15/96	951	942	945
07/16/96	503	481	492	07/16/96	295	283	288	07/16/96	947	944	945
07/17/96	503	487	493	07/17/96	296	287	290	07/17/96	947	941	943
07/18/96	503	484	494	07/18/96	290	279	285	07/18/96	941	936	939

NAWS-CL TP 008

Devils Kitchen Steam Flow 10/95 through 9/96				Well 4H-4 Steam Flow 10/95 through 9/96				Schober's Steam Flow 10/95 through 9/96			
DATE	High, lb/h	Low, lb/h	Avg, lb/h	DATE	High, lb/h	Low, lb/h	Avg, lb/h	DATE	High, lb/h	Low, lb/h	Avg, lb/h
07/19/96	502	485	494	07/19/96	286	277	280	07/19/96	944	936	939
07/20/96	503	487	493	07/20/96	287	277	281	07/20/96	946	939	942
07/21/96	503	489	493	07/21/96	290	282	285	07/21/96	945	941	942
07/22/96	498	484	490	07/22/96	288	280	283	07/22/96	947	940	943
07/23/96	503	484	494	07/23/96	286	279	281	07/23/96	952	943	946
07/24/96	504	484	494	07/24/96	293	282	286	07/24/96	956	944	949
07/25/96	506	489	498	07/25/96	295	285	289	07/25/96	955	946	949
07/26/96	503	484	496	07/26/96	294	285	289	07/26/96	949	943	946
07/27/96	497	478	487	07/27/96	288	280	284	07/27/96	947	938	941
07/28/96	497	481	491	07/28/96	283	272	278	07/28/96	943	937	939
07/29/96	505	481	490	07/29/96	287	275	280	07/29/96	946	939	941
07/30/96	503	484	494	07/30/96	288	276	281	07/30/96	950	940	944
07/31/96	504	483	493	07/31/96	295	282	287	07/31/96	953	945	949
08/01/96	507	489	499	08/01/96	295	286	289	08/01/96	954	948	950
08/02/96	507	489	499	08/02/96	296	277	289	08/02/96	955	949	951
08/03/96	508	490	499	08/03/96	293	285	288	08/03/96	953	949	951
08/04/96	509	490	499	08/04/96	295	287	290	08/04/96	950	938	941
08/05/96	501	483	492	08/05/96	290	279	283	08/05/96	943	937	940
08/06/96	507	487	495	08/06/96	290	277	283	08/06/96	942	936	939
08/07/96	498	484	491	08/07/96	287	275	280	08/07/96	940	936	938
08/08/96	500	484	492	08/08/96	281	273	277	08/08/96	942	937	939
08/09/96	503	484	493	08/09/96	283	273	277	08/09/96	945	939	942
08/10/96	503	487	495	08/10/96	288	274	281	08/10/96	946	942	944
08/11/96	503	485	493	08/11/96	290	281	284	08/11/96	946	942	944
08/12/96	503	483	492	08/12/96	289	279	282	08/12/96	946	933	942
08/13/96	503	484	493	08/13/96	285	274	278	08/13/96	944	934	938
08/14/96	503	484	493	08/14/96	286	274	278	08/14/96	946	940	943
08/15/96	503	487	495	08/15/96	288	273	280	08/15/96	946	940	943
08/16/96	503	489	496	08/16/96	289	280	283	08/16/96	947	944	945
08/17/96	506	488	497	08/17/96	289	282	285	08/17/96	949	944	947
08/18/96	506	489	498	08/18/96	294	282	287	08/18/96	948	945	947
08/19/96	501	483	492	08/19/96	292	283	288	08/19/96	945	938	941
08/20/96	503	484	493	08/20/96	285	275	279	08/20/96	942	937	940
08/21/96	503	481	492	08/21/96	288	276	280	08/21/96	946	938	942
08/22/96	503	487	494	08/22/96	288	275	282	08/22/96	943	939	942
08/23/96	501	484	491	08/23/96	287	277	282	08/23/96	943	939	941
08/24/96	504	485	494	08/24/96	288	275	279	08/24/96	947	937	942
08/25/96	508	489	499	08/25/96	292	276	282	08/25/96	953	944	947
08/26/96	508	491	499	08/26/96	299	285	289	08/26/96	950	948	949
08/27/96	503	488	494	08/27/96	299	286	291	08/27/96	948	942	945
08/28/96	497	484	491	08/28/96	290	279	284	08/28/96	942	935	937
08/29/96	503	484	493	08/29/96	282	276	280	08/29/96	942	935	939

NAWS-CL TP 008

Devil's Kitchen Steam Flow 10/95 through 9/96				Well 4H-4 Steam Flow 10/95 through 9/96				Schober's Steam Flow 10/95 through 9/96			
DATE	High, lb/h	Low, lb/h	Avg, lb/h	DATE	High, lb/h	Low, lb/h	Avg, lb/h	DATE	High, lb/h	Low, lb/h	Avg, lb/h
08/30/96	506	488	494	08/30/96	287	275	279	08/30/96	947	939	943
08/31/96	508	489	499	08/31/96	294	280	286	08/31/96	951	944	947
09/01/96	507	489	498	09/01/96	299	287	291	09/01/96	950	947	948
09/02/96	503	487	495	09/02/96	296	289	292	09/02/96	951	944	946
09/03/96	503	488	496	09/03/96	295	282	286	09/03/96	945	940	942
09/04/96	506	489	498	09/04/96	289	280	284	09/04/96	944	938	941
09/05/96	508	489	499	09/05/96	293	276	286	09/05/96	942	939	941
09/06/96	497	484	490	09/06/96	295	285	288	09/06/96	941	934	937
09/07/96	501	483	491	09/07/96	285	276	280	09/07/96	937	933	935
09/08/96	503	484	493	09/08/96	285	273	279	09/08/96	940	935	937
09/09/96	504	485	498	09/09/96	289	276	282	09/09/96	941	937	939
09/10/96	503	487	495	09/10/96	289	281	284	09/10/96	938	933	936
09/11/96	508	478	493	09/11/96	288	276	281	09/11/96	942	936	938
09/12/96	511	491	499	09/12/96	295	274	286	09/12/96	941	936	939
09/13/96	514	495	504	09/13/96	298	285	290	09/13/96	943	937	940
09/14/96	503	488	494	09/14/96	299	292	293	09/14/96	940	937	938
09/15/96	510	489	501	09/15/96	290	281	288	09/15/96	944	936	939
09/16/96	501	488	495	09/16/96	299	281	287	09/16/96	939	933	936
09/17/96	503	481	492	09/17/96	289	272	283	09/17/96	936	927	932
09/18/96	497	484	490	09/18/96	285	269	276	09/18/96	935	926	930
09/19/96	506	484	498	09/19/96	283	268	277	09/19/96	936	929	932
09/20/96	503	489	496	09/20/96	292	272	280	09/20/96	937	934	935
09/21/96	508	489	499	09/21/96	292	282	286	09/21/96	943	935	939
09/22/96	506	491	498	09/22/96	299	287	291	09/22/96	944	940	941
09/23/96	503	485	494	09/23/96	295	288	292	09/23/96	941	938	940
09/24/96	504	489	497	09/24/96	289	281	285	09/24/96	943	938	940
09/25/96	508	489	499	09/25/96	292	282	285	09/25/96	948	939	943
09/26/96	503	484	493	09/26/96	298	285	289	09/26/96	946	942	944
09/27/96	507	489	498	09/27/96	293	279	289	09/27/96	942	934	938
09/28/96	497	479	491	09/28/96	282	273	276	09/28/96	941	937	938
09/29/96	503	484	493	09/29/96	287	273	279	09/29/96	946	940	942
09/30/96	508	489	499	09/30/96	296	283	290	09/30/96	950	944	946